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CORRECTION

In the article by Dr. Hugo Muench on "The Probability Distribution of Protection Test Results," this JOURNAL, 31 (1936), 677–690, change P to p on the seventh line of page 680 and the n's to s's in equation 16, page 685.

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Of Journal of the American Statistical Association published Quarterly at Menasha, Wisconsin for Oct. 1, 1935 to Oct 1, 1936.

District of Columbia | ss

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Frederick F. Stephan, who, having been duly sworn according to law, deposes and says that he is the Editor of the Journal of the American Statistical Association and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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STATISTICS AND SOCIAL ENGINEERING*

BY JOSEPH S. DAVIS
Food Research Institute, Stanford University

ONE EVENING twenty-eight years ago a beloved New England clergyman, rich in humor and wisdom too, put before a Harvard group of scholars what he termed "A Modest Proposal."[1] He urged the founding of a new graduate school "for the retrogressive re-education of doctors of philosophy." "At the present rate of advance," he said,

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* Presidential address at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, December 29, 1936.

Professor Walter F. Willcox' introductory remarks were:

"This evening we are to enjoy addresses from the presidents of Societies devoted to the study of statistics, politics, labor legislation, economics, and sociology. Fifty years ago such an evening would have been given over to one address perhaps an hour and a half long; and never before, I believe, have more than three presidential addresses been made at one session. Each of tonight's addresses will be shortened to twenty minutes; my main duty will be to hold the speakers to their allotted time.

"Perhaps this multiplication of addresses reflects something more than the multiplication of Societies since the founding of the American Statistical Association in 1839 and the diversification of specialties during the century that has intervened. These five addresses at one session may indicate that a close cooperation of them and other related societies is at hand and foreshadow the merging of thesis and antithesis into a new synthesis. The older politics, economics, and law, even the sociology made familiar to our youth by Herbert Spencer, were all based on the individual as the social atom. The politics, economics, and sociology of today are based mainly on the group; perhaps in future law also will find a similar basis and John Doe and Richard Roe lose their places of honor. This change of the unit of study explains why statistics, the numerical study of groups, is preëminent among modern methods of social study, and why accordingly the newer phases of politics and law, economics, and sociology, rely as never before on statistical methods and find therein a higher unity. The nineteenth was once called the statistical century; perhaps in future the same phrase will be applied with greater truth to the twentieth. At least the addresses which you will now hear have whispered this suggestion to one whose major interest for half a century has been in statistics as a method of study in all the social sciences." [Ed.]

[1] Samuel McChord Crothers, in *Harvard Graduates' Magazine*, June 1909, XVII, 607–11.

> "it is possible for our universities to turn out fleets of intellectual Dreadnaughts whose draught does not allow them to navigate in safety the home waters.
>
> "In the Retrogressive School there will be the opportunity to make the necessary adjustments to the actual situation which under ordinary conditions are more or less painful . . . The course in Comparative Literature will be supplemented by a half-course in Comparative Illiteracy . . . There will be courses on the Superficial, the Obvious, the Hit-or-Miss, the By-and-Large, the Topsy-turvy, the Go-as-you-please, and the other forms in which Truth appears to the ordinary intelligence . . . [The student] will attend lectures on the Heterogeneity of the Miscellaneous, the Unexpectedness of the Inevitable, and the Historicity of the Contemporaneous . . .
>
> "Through various kindergarten devices he will be taught the great truth embodied in the philosophical maxim, 'This is a rum world.' . . . "

These few excerpts will perhaps convey Dr. Crothers' idea. Though humorously put, it had a serious core that was by no means devoid of merit. His plea did not fall upon deaf ears, but it opened no safe-deposit boxes and buttered no professor's parsnips. Long since it has slumbered forgotten in the files of a defunct magazine.

I

Undeterred by the fate of this former proposal, I venture to make another, perhaps less modest and certainly more serious, for the establishment of what I shall call Schools of Social Engineering.

For decades our universities have had, alongside departments and schools of the natural sciences, other schools or departments of engineering and medicine. Professors of physics, chemistry, and biology are flanked by colleagues who concentrate on applications of natural science to serving men's manifold needs and curing or preventing their diseases, and on training engineers, architects, doctors, and surgeons to practice their professions in transforming a "rum world" into something less "rummy." The progress of pure science, and the contributions of engineering and medicine, have been mutually invaluable. Largely as a result, they are revolutionizing our world at marvelous speed, until today there are many who tremble because society can ill adapt itself to so fast a pace of social change.

J. M. Clark, in his stimulating presidential address last year,[2] warned that "the world will not give us unlimited time to work out the answer" to the crucial question whether our social system can be refashioned so as "to use the productive powers . . . so plentifully developed, and to give everyone an opportunity to produce and to earn a living." Rightly or wrongly, I interpret him to mean that we social scientists have this pistol at our heads. As a social scientist—for better or worse—I cannot accept this implication, or fully endorse Broadus Mitchell's "blast": "The business depression points an accusing finger at professional economists."[3] Individually, and as a profession, we have unmistakable shortcomings; but we cannot accept responsibility for the depression or for setting the world right. We have other fish to fry, as Clark indeed pointed out; and the more-and-better fish that we fry are required to nourish a new profession that we can help to breed and mature.

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[2] "Past Accomplishments and Present Prospects of American Economics," *American Economic Review*, March 1936, XXVI, 1–11.

I submit that our departments of economics, political science, and sociology should be flanked by departments or schools of social engineering, economic medicine, political architecture. There specialists in solving social problems could be trained and research directed to such practical ends could be carried on. There is room for social engineering workshops to parallel our engineering laboratories. On the educational aspects of my rash proposal, I cannot elaborate here; and if I seem to make bold leaps across yawning voids, it is because I am desperately trying to keep in step with the inexorable march of time.

Let us, however, frankly recognize the distinction between pure science and its applications, in our field as in others. We do not expect a physicist to build a bridge or a biologist to treat cancer. No more should we, if we are primarily economists, political scientists, or sociologists, set out to be social engineers or social doctors. If our social structure creaks and groans and suffers breakdowns, we should find out what is the matter and why, and we should seek to develop sound principles of social structure; but if we take it upon ourselves to lubricate, repair, remodel, or rebuild this structure, we shall only betray our unfitness for the task. If our "acquisitive society" is sick, we should analyze the pathological condition and try to develop therapeutic principles; but we ought not to write prescriptions and make bedside visits. If our civilization, as catastrophists assure us, is tottering to its fall, we shall prove pygmies instead of Samsons if we undertake to carry lumber to shore it up. If some among us choose to change their profession, let them do so, but do it with their eyes open. The rest of us have indeed a responsibility and an opportunity; but it lies in helping to build up new professions to perform such tasks, instead of amateurishly tackling them ourselves or leaving them to be bungled by quacks outside our ranks.

Already these professions are beginning to emerge. Incidentally and occasionally, our universities are helping train a few vigorous neophytes. But where, in the field of applied social science, are the counterparts of those who have built our lofty skyscrapers, our magnificent highways, our automobiles and airplanes, our Boulder Dam, and of those who have well-nigh won the campaigns against smallpox, typhoid, and tuberculosis? Harnessing the social tides may be more remote than putting Passamaquoddy to work; but surely the arts of building *social* dikes, bridges, and highways can be mastered no less than the arts of fence-fixing and log-rolling. These are not mere metaphors; they correspond to concrete realities. There is urgent need of well-trained, specialized professionals who will concentrate on specific means of correcting our economic, political, and social defects, thereby transforming this half-crazy world into something less topsy-turvy.

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[3] "A Blast Against Economists," *Virginia Quarterly Review*, April 1931, VII, 186.

In recent years the word *planning* has been dinned into our ears. Social planning, economic planning, national planning—these have been phrases to conjure with. In our midst are devotees, indifferents, and arrant enemies of this new cult, with its amazing conglomeration of doctrines. With applied social science just striving to be born, governments have embarked on large-scale social planning. In effect, they have said: "Go to, let us build a new world. The materials are all here. We have only to set about it with a will." This is not the spirit of the scientist or the engineer. We do have the requisite basic materials, and our brain power may be as great today as it will be later; but of the requisite techniques and skills, much must be learned before the more ambitious tasks can be successfully performed. Only by degrees have bridges replaced ferry boats of improving type. In the stage that the engineering art had reached fifty years ago, it would have been disastrous to attempt to build the San Francisco Bay Bridge. It is no less disastrous today to attempt to build its social counterparts while the technique of social engineering is in its present stage.

In the quasi-religion of social planning, however, I see indications of cravings for the services of real social engineers, who will not only plan and execute but bring constructive plans to successful execution, and of social doctors, who will not only prescribe and treat but really cure social ills. In the next fifty years, I make bold to prophesy, the profession of social engineering, under some name or other, will come to rank with those of medicine, law, and engineering; and the development of this profession will prove as fruitful to the progress of social science as developments in engineering and medicine have been to the progress of the natural sciences.

To avoid misunderstanding, let me say that by social engineering I do not mean public administration, nor imply that the profession must be or will be practiced only in the government service. On the contrary, I hold that, in democratic societies, its major development will be outside, just as has been true of civil, mechanical, and electrical engineering, medicine, and surgery.

Time limits forbid me to introduce more academic qualifications or to answer your unspoken objections. If I may say it, with due reverence and respect, God seemed willing and your patience might permit, but it doesn't fit into the planned economy of this session. Let me therefore pass, without further ado, to the question: What is the relation between statistics and social engineering?

II

As we all know, "statistics" is a word of multiple meanings. Sometimes it means *statistical data,* in crude, refined, or elaborated forms. Sometimes it means *statistical methods,* from the more elementary, which all statisticians are supposed to have mastered, to the more refined, before which many of us are still illiterate.[4] Sometimes it means the *statistical process* of solving problems with the aid of statistical data and methods.

Statistics may or may not be one of the essentials of modern social science. I think it is, though there is place for social scientists who realize that they know nothing of statistics. At all events, statistics is basic to social engineering. Perhaps nowhere else, even in business and government, is the proper utilization of statistics more truly vital. Representing a statistical association, I can appropriately emphasize this point; but I do so without claiming priority for statistics, or elevating it to a position of unique importance, in the training and practice of the new professions. I do not mean that one must master all known statistical techniques before he can qualify as social engineer or social doctor, any more than a qualified civil engineer must be a Ph.D. in physics or a reputable physician a Ph.D. in anatomy or physiology. I do mean that a thorough grounding in statistics is no less essential for entrants into these new professions than engineering sciences are for would-be engineers and pre-medical courses for budding doctors; and that statistics must be constantly called into play in the practice of these newer professions.

To more learned statistical brethren I leave elaborations on the importance of refinements in statistical technique. My silence about these implies no disparagement. In the actual use of statistics, however, the more elementary principles are called into play hundreds of times more often. Simple though these may seem, it is distressing to find how commonly they are violated. I speak of such things as discrimination between good data and bad, the proper use of aggregates, averages, and indexes, construction of tables and charts, and other phases of the "art of statistical exposition"—the everyday tools of one who uses statistics.

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[4] Compare the presidential address a decade ago by Leonard P. Ayres, "The Dilemma of the New Statistics," *Journal of the American Statistical Association,* March 1927, XXII, 1–8.

One of the grave defects in our elementary and university education is that pupils "cover ground" without really mastering the rudiments. Students emerge with college degrees who cannot add, subtract, multiply, divide, spell, punctuate, and make sentences with a fair approach to accuracy.

In the field of statistics corresponding defects are all too common. Students compile data not worth compiling, manipulate data not worth manipulating. They compute arithmetic means, medians, and modes, but too often without learning where each is appropriate, what care to exercise with respect to the data averaged, and when any sort of average is only misleading. They use adding machines to arrive at huge aggregates, ignoring what Dr. Crothers called the "heterogeneity of the miscellaneous." They apply formulas for computing trends, often blind to the fact that what they have computed utterly fails to indicate a true trend. They work up indexes on the unethical principle of *caveat lector*. They compute coefficients of correlation without realizing what these mean or when they have no meaning. They confuse mere association with causal relationship. They apply methods that produce confusing or misleading results, which they themselves are unable to recognize at their true worthlessness. They learn procedures of meticulous checking, and perhaps apply them assiduously, but remain ignorant of the higher art of super-checking by which flagrant mistakes can be detected. They calculate standard errors, but overlook multitudes of sub-standard errors. In a word, they "strain at a gnat and swallow a camel."

Unfortunately, this diatribe of mine does not apply to students alone. I doubt if any group of workers has a larger representation of experienced gnat-strainers and camel-swallowers than those who deal with or dabble in statistics. Indeed, the American Statistical Association has its quota of them, and its justification for existence lies partly in trying to overcome such defects. There is increasing need for statistics—for estimates and guestimates, for forecasts and backcasts, so long as the nature and basis of each is made clear. But we have too much of hit-or-miss-statistics. Statistics are proverbially dry—forgive me if I say they are far better dry than "wet"—but to give them optimum moisture content is simply a matter of mastering fundamentals that no one should hold in contempt.

In purely academic activities such shortcomings as I have noted are serious indeed, but their full seriousness is not readily revealed. In the applications of statistics in social engineering, however, practices are put to acid tests. If the bridge-builder underestimates the strains to which the structure will be subject, overestimates the extent to which foundations, abutments, and cables will stand stresses of various sorts, and fails to provide an adequate margin of safety, the bridge will fall. If he makes the opposite mistakes, the cost will be excessively increased. It is similar with the builder of new social structures, small or great; defects of calculation and estimate lead to waste if not to destruction.

You will see that I am no Pollyanna. Neither am I a prophet of disaster or doom, and I cannot close on a critical or pessimistic note. I envisage the rise of a new profession of social engineering, with a future truly great. To its development we social scientists have much to contribute, and from its progress social science has much to gain. In the training and practice of that profession, right use of the rudiments of statistics is one of the bed-rock essentials. In the constructive work of the American Statistical Association, one of the most worthy objectives is to promote the effective linkage of statistics and social engineering.

CORPORATION STATEMENTS AS THE BASIS OF INVESTMENT POLICY*

By Laurence H. Sloan, *Vice-President*
Standard Statistics Company, Inc.

Expressing only the viewpoint and desires of the investor, as he is sometimes called, and ignoring entirely the corporation's viewpoint and interests, the following are among the important attributes which an official corporation financial statement should possess:

1. It should be truthful.
2. It should state the truth clearly, plainly, and adequately, so that all of those who have a financial interest in the situation would have the same understanding of it.
3. It should report the truth with reasonable promptness.
4. It should convey truthful information to *all* investors *simultaneously.*
5. It should provide the basis for *forecast* of future earnings and dividends.

In a moment we shall return to these various badges of virtue, inquiring as to their practicability, as to whether the situation is tending toward improvement or deterioration, as to what can be done about the matter which is not already being done or attempted, and so on.

But before doing so, it may be well to scrutinize one popular illusion and to raise one rather unpleasant, but essential, question.

The popular illusion is that income accounts and balance sheets can be devised and presented in such a way that they will prove a valuable guide to the so-called "average investor." The average investor himself is perhaps an illusion. But if he does exist, he must be of no better than average intelligence, and raw corporation financial statements are not for the like of him. They are technical instruments in their very nature, drawn by experts and mainly for the use of experts. What the mythical average investor needs (if anything) is an *interpretation* of the financial statement. One gets nowhere at all with a discussion of the needed improvements in such documents until the so-called average investor, with his average powers of mathematical comprehension, is erased from the picture.

That brings us to the question of the function, as contrasted with the purpose, of the corporation financial statement.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 28, 1936.

In the discussion at Washington which formed a back-drop for the passage of the 1933 and 1934 Securities Acts, the phrases "protection of the investor" and "welfare of the investing public" were often used. Certainly the public welfare would be furthered by choking off the supply of bad new issues, if that could be done, because instruments of this sort occasion a sheer waste of capital, and that does no one any good. But there is really some question as to whether truthful, adequate and prompt financial information, via the route of corporation statements, contributes to the welfare of the *entire* investing public. The basis for this question arises from the fact that the investing public as a whole has only itself from which to buy securities, and only itself to which to sell securities.

This being the case, it is rather difficult to figure it any other way than that good financial information relative to a given corporate situation abets the wise investors in taking advantage of the mistakes of the unwise ones. If at the peaks of bull markets we Americans could sell our securities to the Chinese or Fiji Islanders, and buy them back again at the end of bear markets, there might be at least a *national* advantage thus to be gained.

But it doesn't work that way. In the main, we can sell only to each other and buy only from each other. In theory, although not always in practise, adequate financial information merely enables the informed investors to buy from the fools at the right time (that is, at the right time in the informed investor's reckoning) and to sell to the fools at the right time.

This is not an academic question. It so happens that both in connection with new offerings and with annual statements, a great deal of important information, not otherwise available, is filed with the Securities and Exchange Commission at Washington. The investor who can afford to have this extracted, summarized and analyzed, certainly has some advantage over the investor of the so-called average type who doesn't know the information is "available" at Washington, who never thought of sending to Washington for a photostatic copy of anything, who wouldn't know what to ask for anyway, and who wouldn't know what to do with it after he got it back.

Now back to our list of desirable attributes for corporation statements. Point No. 4, stressing the desirability of all investors receiving truthful information simultaneously, is idealistic and thoroughly impractical. To insist that stock or bond owners of Corporation X should receive important financial information relative to the corporation as promptly as it is received by those security owners who are members of the management (i.e., the well-known insiders) is to insist upon one of two impossible circumstances: either (a) daily, weekly, or at the outside, monthly statements to the public, or (b) that the management itself shall not keep itself informed up to the minute about the company's affairs.

You can talk all you want to on the subject, and you can pass as many laws as you want to, but the fact still remains that there is absolutely no way, as our economic mechanism is now set up, to prevent the insiders from being ahead of the mob in the matter of corporate knowledge, and there is probably no way to keep them from profiting thereby.

So that brings us to the desirability of financial statements issued with *reasonable* promptness. That term can be defined, for our present purposes, with considerable definiteness. It means a *quarterly* financial statement, issued not more than six weeks after the end of a quarter. Such a requirement would seem to be both a reasonable and practical one.

All of the objections are by now quite familiar . . . the alleged deceptiveness of quarterly statements reporting the condition of a business that is highly seasonal; the difficulty of gathering data from abroad by corporations with an international complexion; the expense of frequent inventories and audits, etc.

The plain truth of the matter is that an annual statement, issued four to six months after the close of the fiscal year, and therefore reporting a situation which had its beginning 16 to 18 months earlier, is thoroughly obsolete in our present day investment machinery. Many corporations which do not now report quarterly could readily do so, without harm to their trade position, and without significant additional expense. Hardly anyone is so unsophistocated as to believe that the corporations which still report only once a year do not privately compute their positions much more often than that.

The Securities and Exchange Commission has been vested with the power to require registered corporations to render quarterly reports. It is this speaker's uninformed forecast that many corporations which do not now report quarterly will be doing so before the end of 1937.

As regards the basic truthfulness of corporation statements, it may be flatly said that the establishment of the Securities and Exchange Commission, with the body of legislation which governs its powers and actions, has for all practical purposes completely eliminated outright fraud and conscious deception from the income accounts and balance sheets of registered corporations. The penalties of violation are too severe to make the violations themselves seem worth the candle to most corporation executives and accountants.

In other words, this phase of the matter is now in the nature of a closed book. Conscious fraud has been legislated out of corporate financial statements; the legislation enjoys quite a high degree of success.

But even after the elimination of flagrant misstatement, the consumer of corporation statements still has a thoroughly adequate opportunity to misinform himself. He may do so without the reporting corporation having evaded by so much as a hair's breadth any existing law, and without the accounting profession having violated even the smallest item in its existing code of ethics.

To begin with, the statements which corporations still send to their security owners are not always identical, by any means, with those which are filed at Washington when a new issue is offered, or regularly once a year on the well known Form 10. Form 10 provides for the expression of truthful financial facts with reasonable clarity and adequacy. Expert analysts often want more, in specific cases, but broadly speaking, Form 10 information meets the run-of-mine of reasonable or average requirements. But many corporations still reserve the adequacy and clarity of Form 10 information for the SEC; stockholders are still receiving those briefer and more tricky statements which were a part of the financial trappings of an earlier era.

This is a significant fact, but not one of over-powering importance since, technically at least, the more complete information *is* available.

More important is the fact that established accounting practise, and trends of thought and theory within the accounting profession itself, still leave ample room for misinterpretation and misunderstanding. It may be said without fear of dispute that fully half the items in both the income account and balance sheet are set up not on the basis of incontroversial fact, but on the basis of someone's judgment or opinion as to proper accounting practise.

We all know how reserves for depletion and depreciation are made to vary, not only from one company to another, but within a given company from one year to another. We all know how significant an effect upon reported net earnings results from arbitrary variation in this single item.

The handling of inventory reserves can result in a similar distortion of reported earnings. Under the cover of unexplained debits against surplus or credits to surplus, can exist a veritable multitude of accounting sins.

I am not going to explore this particular avenue in further detail, because I fear that to do so would be to trespass upon what Mr. Sachs is going to talk about. The present purpose will have been served if we merely note in passing that we have not yet reached the absolute in the way of wholly satisfactory corporation statements, even though we have been making giant strides in that direction during the past three years.

Finally, we come to a brief examination of the *forecast* significance of corporation statements. Forecast of corporation earnings and dividends is the objective of all investment analysis, whether it is called by that blunt name or some other. The intelligent investor does not examine a statement merely to gratify his curiosity as to whether he should have bought or sold a year ago, or six months ago, or even yesterday. He examines it with the idea of forecasting a future trend, so that he can know what action to take today or tomorrow. In any event, he forecasts.

That are no statistics which reveal the volume of security transactions which is directly stimulated by the publication of official statements. But I am sure the amount of dealings so originating is very, very small. The whole modern conception of expert investment analysis is that it should be forward looking; that it should provide itself with tools for determining action *between* the issuance of official statements. This applies not only to the short term trader, or speculator, but to the long pull investor as well. In fact, the so-called long pull investor is almost as mythical as the average investor. Outside the institutions—insurance companies, trust companies, banks, etc.—about the only long pull investors who really exist are the ones who can't do any better than that. They would much prefer to do the job in a short time; probably 99 per cent of them *hope* to do it in a short time; they become long pull investors, in the main, either when they find themselves locked in by a severe price decline, or when the short term movement for which they hoped fails to mature.

And even the most Simon pure of the long pull investors can offer no justification whatsoever for re-checking his commitments no more often than at statement issuing time. There could be no quarrel with the assertion that many institutions now and then do a terribly bad job with their forecasts, but that doesn't mean that they sleep comfortably with their securities for a year at a lap, with no effort at an intermediate check.

What is the basic nature of the type of forecast here under consideration? Simply this: to so understand the affairs of a given corporation that outside events, which occur between statements, may be used as the basis for intelligent conjecture as to their probable immediate and future effects upon the earnings of such a corporation.

Two examples will make the meaning clear.

Between October 24 and November 6, 1936, the domestic price of copper was advanced ¾ of 1 cent—a very stiff advance, for this particular market. This provides the basis for the very simplest type of investment forecast. Even the least imaginative customer's man in Wall Street could lift his telephone and flash the obvious news that an increase in the profits of the domestic copper producers was indicated.

The matter becomes considerably more complex, however, when we are dealing with events which affect the producers of multiple products. What does an important increase in automobile truck production, as revealed by the monthly figures of the Department of Commerce, mean to a company such as International Harvester, which is a large scale producer of trucks *among other things*, but which issues financial statements but once each year?

For purposes of that segment of investment analysis which aims at forecast, perhaps the most important *single* item in the financial statement is gross income. If, in addition to *net* income, the informed investor can know the gross amount of money which comes into the till over a given period of time and under a given set of conditions, his task of estimating net under *altered* conditions is greatly facilitated.

Equally important is a break-down of gross, showing the precise amount of money from the sale of each product, the amount of income from each investment, etc.

Most corporations object to publication of gross income figures. A relatively small percentage of those which disclose this information do so willingly. Slowly the list has grown over a period of years, as the requirements of the New York Stock Exchange have become more rigid. Form 10 at the Securities and Exchange Commission has disclosed this item in certain additional cases, but for the most part the corporations which have vigorously resisted the publication of gross have, up to date, been able to convince the Commission of the desirability of still maintaining these data confidential.

Apparently the investment community will have more gross income figures in 1937 than in any previous year.

Publication of a break-down of gross is even more vigorously resisted than is publication of the aggregate figure. There is no current evidence that public authorities have any intention of pressing this phase of disclosure very much farther. Over a long period of time this information, in approximate terms, and applicable to the majority of important corporations has found its way into the public and confidential records of the investment community. Seemingly this unofficial, word of mouth, back-door type of gross break-down is the most that can be expected for some time to come.

As a corporation official I should actively oppose publication of a break-down in gross, for many obvious reasons; as an investor, I cry aloud for this information. It is very desirable—indeed, virtually essential—for the interpretation of events which fall between the issuance of statements. Lacking the exact details, a reasonable approximation is obviously better than no information at all. In any event, informed analysis starts from a knowledge of how much money comes in under a given set of conditions, and of where it comes from. Such information is germane not only to the careful investor's long term policy, but to the definitive market action of the wise investor, as previously characterized and described.

The entirely perfect financial statement, the ideal one in the viewpoint of the intelligent investor, probably will never be. What the careful and informed investor regards as ideal would conflict too sharply with reasonable and defendable corporation policy. However, many of the faults and shortcomings of corporation statements are in the way of being cured. Additional curative ministrations are in prospect. It would be both an unfair and an uninformed observer who did not give a large share of credit for this improving situation to the intelligent work of the Securities and Exchange Commission.

STATISTICAL REQUIREMENTS OF THE SOCIAL SECURITY BOARD FOR EFFICIENT ADMINISTRATION*

By Arthur J. Altmeyer
Chairman, Social Security Board

This is a subject which is of concern not only to active participants in the social security program, but also to many on the outside who have either a direct or an indirect connection with social security. For the past year the Social Security Board, as well as the other State and Federal agencies which are concerned in the program, has devoted much attention to this question of the data which are essential for successful administration of the law.

There are certain general principles which must govern work in this field. The first of these principles is that statistics may and do serve as a guide both to short-run administrative performance and to long-range policy making. Both are needed in the proper balance in any security program, although the proportion may differ from time to time as the program develops.

An administrator must emphasize two facts: (1) that the same statistical data frequently serve both administrative and research purposes, and (2) that research seldom requires a large volume of statistical data to provide answers to questions of policy. If the collection of certain data is justifiable on administrative grounds, there certainly can be no basis for criticism in the fact that the same data may also serve long-range research purposes.

A second general principle is that the data essential for administration must be governed in part by the character of the law to be administered. For example, the information required for old-age benefits and unemployment compensation is not always identical. Every effort will be directed toward simplification and unification; but the fact remains that the administration of unemployment compensation necessarily differs widely from the administration of old-age benefits, and the requirements of the two systems naturally differ.

A third general principle is that the data which are essential to efficient administration are necessarily determined by the nature of the administrative organization established by law. The administrative organization and the procedures which are necessary under it are in large measure already determined for the administrator when he begins his work. Thus, the Congress of the United States decided that unemployment compensation should be administered in this country on a Federal-State cooperative basis, but that old-age benefits should be established on a strictly Federal basis. In such an administrative structure certain types of data are required which would not be so necessary in some other form of administration. For example, some knowledge on the nature and extent of interstate migration of labor is absolutely necessary for unemployment compensation, though for old-age benefits no such problem arises.

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* A paper presented at a Joint Session of the American Statistical Association and the American Association for Labor Legislation, Chicago, December 28, 1936.

ADMINISTRATIVE REQUIREMENTS

What are some of the specific problems which are facing social security administrators at the present time? The first item on the list relates to contributions. The Federal tax on employers of eight or more, which constitutes the basis for State unemployment compensation acts through a system of tax offsets, is already in effect this year. The employer and employee taxes covering the costs of old-age benefits, began on January 1, 1937. In both cases the following would seem to be the very minimum data which must be obtained:

a. The coverage—number of employers, the number of establishments, and the number of employees therein.
b. The amount of taxable wages paid by these employers to these employees.
c. The taxes paid by employers and (if any) by employees.

These items of information are needed at frequent intervals (monthly or quarterly) by individual employers, by major industry groups, and by place of employment—by States and by major areas within the State. The need for these data is not based upon any abstract or long-range research program; these elementary facts form the basis for immediate administrative decisions.

There are complications in obtaining even these apparently simple items. The coverage of the Federal employer tax may not be the same as that of a State; the definitions of wages may not be identical. The coverage in old-age benefits is wider than in unemployment compensation. These facts make it all the more important that precise and accurate data should be available for each class of coverage.

A second item of equal importance, though not immediately so pressing, is that of benefits. There is a period of two years after taxes begin before unemployment compensation benefits can be paid. Under the Federal old-age benefits plan, monthly benefits are not payable for five years, although death and retirement benefits are payable immediately. In both cases the wages which constitute the basis of ultimate benefit payments must be taken into account almost immediately, because when claims are later presented it will be necessary to have available all the facts which are required to determine the amount of the benefits which are due.

At the present time a debate is being waged concerning the respective merits of requiring current detailed payroll reports and requiring separations reports only. The detailed payroll report system is much to be preferred for research purposes, but the final decision must necessarily be based upon administrative grounds, particularly the effect upon claims procedure. The goal must be the prompt payment of benefits, and whichever system best serves that purpose is the one which should be adopted. It may be that a combined system will prove most practicable.

A third item which may be mentioned briefly is that relating to placements. With large numbers of unemployed workers passing through the compensation commissions' organization regularly, it will be important to extract from the records data relative to registrations, interviews, referrals and character of placements.

LONG-RANGE RESEARCH

There are at least two major problems which have much more than short-run administrative implications. One is the problem of merit-rating in unemployment compensation. Both the Federal and the State acts require a period of experience before merit-rating can be instituted. During this period some study of the problem will be necessary, sometimes in order to determine what the merit-rating system shall be, in other cases to determine whether the system written into the law will need to be modified. This is an intensely practical question, although it may properly be considered under the head of long-range research because of the time element involved. Three years from now it will begin to be an immediate administrative problem.

The second major question is the problem of solvency—the long-run balance between the amounts paid in benefits and the amounts available in the compensation funds. In unemployment compensation it will be necessary to determine State by State whether the compensation fund will be adequate to meet the schedules of benefits which have been established.

What can the administrator do? He must insist upon having available for his use such data as can be collected upon the incidence of unemployment and its duration, case by case, industry by industry, employer by employer. The unemployed will have to be classified by age and sex; the nature of part-time will have to be clearly defined and recorded. It should be clear then that administrators must necessarily require statistical data which will answer these questions concerning unemployment. It is not only possible but desirable that such data be secured as a part of the ordinary routine operation of the program.

COORDINATION AND SIMPLIFICATION

Despite the urgent necessity for data in the administration of the social security program, a most rigid inspection will be maintained on the data actually requested. Every effort will be made to coordinate the data collected so that duplication can be avoided.

There are three points to be considered in such a program of simplification. In the first place, it can be achieved only within the limits of the laws which must be administered. Insofar as an administrator finds his program defined for him, he must adapt his data requirements to the necessities of the case.

Secondly, many employers must necessarily consider the adaptations of their records to the needs of social security. Some employers keep adequate records for this purpose and will not need to make any change in their record-keeping system. Other employers have a system which is not readily usable, and these may have to make some readjustment. Some employers apparently keep no records at all, and these will have to institute some kind of a record system. It is my conviction that the reports required by the social security program are not such as to constitute an undue burden on employers who maintain records adequate for their own business purposes.

Third and last, it is important to note that this program is still in a formative stage. Different bases of benefit computation have been instituted in different States. Some of these involve fewer and simpler records than the others. Administrative experience will finally work out that system which best combines administrative efficiency with reasonable cost. During this period it is essential that the administrators and employers cooperate closely so that the needs of the former and the convenience of the latter are both taken into consideration. The Social Security Board will do its utmost to cooperate with State administrative agencies and other Federal administrative agencies with these two paramount objectives in view: First, to reduce to the minimum the number of reports and content of reports required; and second, to increase to the maximum the effectiveness of the analysis and presentation of the data contained in such reports.

MINIMUM STATISTICAL REQUIREMENTS FOR EFFICIENT ADMINISTRATION OF UNEMPLOYMENT COMPENSATION SYSTEMS*

By George E. Bigge
Brown University

In discussing minimum statistical requirements for the efficient administration of the Social Security program I shall confine myself largely to the requirements of the Unemployment Compensation systems, without much reference to the Placement Service, or to Old Age Benefits, or other provisions of the Social Security Act. No one will deny that many of these problems are closely related. They deal, in the main, with the same people, and the same relationships: employment, unemployment and under-employment; jobs, wages, and insecurity, and the like. Yet no one will insist that all of the facts and data are equally important in dealing with the several aspects of the larger problems.

Moreover, some data are for general purposes only, for determination of policy, and not for administration. For example in the administration of Unemployment Compensation and Old Age Benefits, we have to do with contractual obligations to individual workers. To meet these obligations properly, we need a record of employment and earnings of each individual over a period of years. For administrative efficiency the reports and records involved here should be of such nature as to be easily verified, readily available for information on request, and should lend themselves to the determination of eligibility, and of benefits, without delay. Obviously these criteria would be of relatively little importance in judging a similar system of records from the point of view of policy determination.

In limiting my discussion to Unemployment Compensation, I am not ignoring the importance of these other aspects of the program. In the long run, it is undoubtedly more important to place an unemployed man in a new job, than to pay him benefits, however efficiently that may be done. Since this is true, the community will find a way to get the proper information on which to base a sound employment policy. Nevertheless, it seems clear that the types of information required for these two lines of attack upon the same problem, are sufficiently different to be considered separately; and I am leaving aside for the present, the needs of the policy-making functions or agencies.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association (at a joint session with the American Association for Labor Legislation), Chicago, December 28, 1936.

The administrative requirements for Old Age Benefits, once the registration has been completed, are sufficiently simple to fit into the minimum requirements for Unemployment Compensation. True, the coverage is not the same and adjustments will doubtless be made in this respect, but the *type* of current information required for the latter is sufficient for the former also. I shall therefore limit myself, as indicated, to the requirements of the Unemployment Compensation program.

One of the greatest difficulties encountered in a discussion of this subject is that the administration of Unemployment Compensation is in the hands of the several states. Although the standards prescribed by the Social Security Act induce a certain amount of uniformity in the various state schemes, still each state act, in its provision for the determination of eligibility, or of benefits, lays down certain requirements which condition the administrative procedure which can, in practice, be adopted. None of these requirements however, unless it be that with reference to merit rating, can be said to affect the basic purposes of the program. And I assume we are interested here in what data *should be* required to make such a program workable; not in what *is* required by specific laws now in effect. I shall therefore in the main ignore the details of the several state laws, and consider the question from this more general point of view.

In formulating the specific requirements of such a program we must keep in mind the fact that in this social security legislation we are dealing with a larger number of people in a more intimate way, than in any other legislation we have ever attempted. This is particularly true where there are contributions from employees as well as from employers. The income tax affects only a fraction of the number of people who pay the security taxes; and most of the other forms of taxation and regulation are so well hidden that the citizen is quite unconscious of what is happening to him. But here we face him with the facts every time he pays, or receives wages. As someone has well expressed it, this is a major problem in public relations, as well as a problem of taxation and disbursement. The good will of the people with whom we deal is essential if the program is to work effectively. For this reason I suggest that any procedure adopted should bear as lightly as possible upon the employer; and should assure the worker of fair treatment.

One of the first things done by the state board with which it was my good fortune to be connected was to assure employers that no unnecessary data would be required, and to invite them to cooperate with the Board in devising the simplest adequate procedure. The response was most gratifying and continues to bear fruit. The official in charge of

Old Age Benefits registration tells me that, due to the cooperative attitude of employers—which he attributes largely to the earlier experience with Unemployment Compensation—he had turned in, at an early date, 102 per cent of the registrations expected in the state.

A second point on which I imagine all can agree, is that in judging the efficiency of any system we should count the whole cost of recording and reporting data; to the employer as well as to the state agency. This may appear self-evident, but I fear it is frequently overlooked in comparing the costs of operation of various plans. Obviously, any attempt to make cost comparisons between a state which requires all relevant information to be sent to the state agency, all records being kept and all computations made there; and that of another state operating on a system of separation reports, where the employer keeps all current information in his files, and transmits a copy of it only periodically, or when a worker leaves his employment; would be entirely unfair if it failed to take account of the employer's expense in this connection.

Also, in judging the efficiency of any system we must keep in mind not only present costs but long-run needs. We have all had experience with policies which were "penny wise, and pound foolish" in this respect. The purpose of all of our security programs, except for the element of prevention which appears in some, is the prompt and fair payment of the correct amount of benefits to eligible workers. Clearly a system which is altogether satisfactory for the purpose of collecting contributions, may be entirely inadequate for the purpose of determining eligibility for benefits, or for computing the amount of benefits due in any case.

For example, let us assume that a state is operating with only separation reports, all detailed information for employed workers being in the hands of the employer. At the moment, and while no benefits are being paid, this is much more economical both for the state and for the employer than a system calling for periodical detailed payroll reports. But when we consider the high rate of labor turnover in American industry, and remember that when a man leaves his job the employer must under most such schemes send his employment record to the state agency, it appears that in the course of time the employer, on the whole, will report about the same information under either system. Many workers, especially in irregular industries, will have a number of such reports, from different employers, in a single year. And the state will have to file these reports, which will doubtless prove much more bulky than individual ledgers. Furthermore, when benefits are to be paid, these reports must be utilized either to compute the benefits payable, or to check the employer's computation. I venture to suggest that if both employers' expenses, and those of the state are taken into account, over a period of years, the system requiring current reporting of payroll information will be found the more efficient in meeting the needs of *existing* laws, in most states.

Most of the inclination toward employers' record-keeping in preference to state record-keeping, I believe, derives from looking at the problem from the point of view of employers' reserve funds, rather than that of the pooled fund. The former leads one to think of the employer as insuring his own workers against unemployment, in which case he naturally would keep the necessary records. The state would act only as auditor, or perhaps custodian of the funds and see that the employer treats the workers properly. In case of the pooled fund the state undertakes to provide a measure of security against the hazards of unemployment, and calls upon employers and workers to make such contributions and give such cooperation as may be necessary to accomplish its purpose. The former aims chiefly at preventing unemployment, the latter at assisting the unemployed. There can be no question that prevention of unemployment is by far the more desirable end, but it is by no means clear that it can be achieved by this method. And since this is the case it will be well to recognize throughout, the additional burden of records to which the whole system is subjected in attempting to apply this particular policy.

The same reasoning applies to the merit rating provisions written into many of our state acts; that is, the proposal to adjust the contribution for each employer according to his employment record. While this may or may not lead to additional record-keeping by employers, it does require a kind and amount of detail in the records kept by state agencies which is not necessary where merit rating is not contemplated. In considering minimum requirements, I suggest that we stop for a moment to examine the underlying notion of the merit rating proposal, to see whether it is worth the effort involved in making it effective.

The proposal as suggested above, rests upon the assumption that an employer can reduce unemployment among his workers if he will try. The variation in the premium rate is to stimulate him to do this. But also, it would seem to assume that wherever employment *is* more regular it is due to the employer's efforts. This, of course, is by no means the case. If there is less unemployment in newspaper publishing, or in the telephone industry, than in building or coal mining, it is due very largely to external factors over which the employer has little or no control. In a system of social insurance there is no good reason for reducing the tax on those on whom the burden of unemployment falls least heavily. If the premium is to be adjusted to the unemployment record of the individual employer, justice would seem to require that his experience be compared with that of others in the same industry; a building contractor with others in his line, a newspaper publisher with other publishers, etc., and not with the average for all industry.

In this connection it may be well to digress long enough to point out that we are too much inclined to think of Unemployment Compensation in terms of our experience with Workmen's Compensation. Workmen's Compensation laws tended to prevent or reduce accidents, why should not Unemployment Compensation prevent unemployment! But the problem of accidents and that of unemployment are basically different. The problem of accidents relates to production and is, therefore, to a large extent, under control of the producer, or employer. The problem of unemployment, on the other hand is a phenomenon of the market, and is related more directly to consumption. Over many factors affecting unemployment the individual employer has little or no control. If employers are to attack this problem effectively, it must be done by concerted action. And this is in line with the idea of a pooled fund, not of individual employer's reserves.

This is not to say that individual employers can do nothing to regularize employment. There is ample experience to prove that good management can do much to eliminate or neutralize seasonal and other short time fluctuations in employment. But it has yet to be shown that the small savings in premiums which can be achieved by regular operation is likely to be sufficient to induce regularization by employers who would not otherwise have done so. Certainly the experience in the Chicago clothing market is by no means convincing.

Perhaps we shall find it worth while to consider the experience of England in this connection. The English began by allowing certain industries to "contract out" of the insurance scheme. Presently, however, this was abolished, and after twenty years of experience we find the opposite suggestion coming to the fore. The more recent proposal is to separate out certain industries which are notoriously *irregular*, and accord them special treatment in the sense that they may be required to observe much more stringent rules, must engage all labor through the public employment agencies, and the like. This "scheduling," rather than merit rating has not been carried out to any great extent, but it would seem to be far more equitable, and probably more effective in dealing with unemployment, than the granting of special favors to those already favored by existing conditions. And it is on the basis of its effectiveness in preventing unemployment that the merit rating principle must rest; to say that it is *unfair* to make employers and employees in regular industries contribute for the benefit of workers in irregular industries, is to overlook the nature of social insurance.

I would suggest, therefore, that the principle of merit rating, and the variation of contribution rates in accordance with such rating is unsound and might well be abandoned. In its place I would suggest "scheduling" those industries which are particularly irregular in operation, and requiring them to make such reports and follow such procedures as seem necessary for effectively dealing with their problems. They may well be set up as a separate group required to pay higher contributions and submit to other special regulations. But this would apply to a relatively small portion of the whole field, and would relieve the Boards of the necessity of setting up the general record system to carry back each worker's record of employment and unemployment to the account of individual employers over a period of years, as is necessitated by the merit rating provisions.

The community would still want to know the facts regarding the variation of employment between other industries, the fluctuation in employment, etc. The question then arises whether in setting up our Unemployment Compensation records and reports we should limit ourselves to what is necessary for efficient administration of the contribution and benefit provisions of such a program; or whether we should use these as a convenient vehicle for gathering various sorts of information which will enable us to deal more intelligently with the problems of unemployment, under-employment, wages, hours, placement, and the like. It has been my contention throughout that even when reduced to its simplest terms, the problem of contributions and benefits is so enormous that we should not complicate it by unessential additions, however significant these may be in themselves. If it seems desirable from time to time to get additional information for the determination of policy, this can be done by calling for special reports, not as part of the unemployment compensation reports, but supplementary to them.

These observations regarding the general problems involved, lead me to the following conclusions:

1. We should require, currently, only such reports as are essential to the effective administration of the system of unemployment compensation itself, and not try to make them serve other general purposes of a statistical nature. Certain statistical studies can be undertaken on the basis of information that will be available in any case, but no special information should be included in the compensation records solely for statistical purposes.

2. Systems of "Employers' Reserves," or "Merit Ratings" systems require special records. The chief justification for such systems is that they tend to reduce unemployment. Their efficacy in this respect is open to question and since the purpose can be accomplished, better perhaps, by special attention to the *irregular* industries, we should consider requirements for other purposes, and judge the merit rating elements separately in terms of added costs.
3. In counting costs we should consider *all* costs, to the employer as well as to the state; and over a period of years, not only in the initial period.
4. If this is done, most of the advantages of the separation report system which leaves the basic information in the hands of the employer, except at the termination of employment, will disappear, and it will be found no more burdensome to report essential information periodically to the State agency. Incidentally, such centralized record-keeping is desirable as a matter of convenience, to guard against possible loss of records, and as protection, by a responsible public authority, of the workers' interest in the program.

The reason we have shrunk from this conclusion, I think, is because of the staggering burden of records and reports involved. But if we admit the conclusion, perhaps we can find a better solution for the problem than merely ignoring it, or postponing the burden to the future. The basic information necessary for effective administration depends upon the conditions of eligibility, and the method of computing benefits. Most state acts base eligibility on past weeks of employment, and benefits on average, or full-time, or normal weekly earnings, with certain minimum and maximum limits. Most of the acts also provide for merit ratings, or at least require records to be kept for the study of merit rating.

Some months ago after prolonged discussion, it was agreed by a committee of the interstate conference that, under these conditions, efficient administration required the current reporting of persons employed, hours worked, and wages paid, by establishment. Nothing less seemed adequate. The officials of the various states, and of the Social Security Board, and representatives of employers and various business services attacked the problem of providing this information in the simplest form. I recall our first session in Rhode Island with the representative of a certain business machine concern. The procedure then suggested would have involved a staggering burden of reporting, transcribing and filing. In a few weeks we had devised special forms which reduced the burden enormously. Others made similar progress so that the problem, while still a stupendous one, has already been reduced to manageable proportions.

But this was only the beginning. Within the last few weeks suggestions have been made for modification of the state laws so that *earnings*, rather than hours or weeks of employment shall be the basis for determining both eligibility for benefits, and amount of benefits. This, it seems to me, from the point of view of simplification of procedures, is the most important advance made since the beginning of our discussion of Unemployment Compensation. Also, it is directly in line with the observations made earlier in this discussion. It makes possible the elimination from the reports of all but the most essential information. The hours or weeks of employment, over-time, short-time, and the like, are interesting facts, but not essential to the fair determination of eligibility, or of benefits.

Briefly, the proposal is that a person shall be eligible for benefits if he has earned, in a certain period of time, say a year, a certain specified minimum amount, or a certain multiple of the amount he will receive as weekly benefit. In other words, he becomes eligible on the basis of what he *earns*, not the *length of time* he works. Benefits, under the proposed scheme, would also be based on *quarterly* earnings, over a period of time, and limited to a certain relationship to total earnings.

Such a scheme has much to recommend it. In the first place it lends itself to more accurate computation of the probable claims, than a scheme which relates contributions to earnings, and benefits to weeks of employment. In the second place it eliminates the necessity for including in the employers' regular Unemployment Compensation reports, and in the records of the Boards, the hours of work, and weeks of employment. It will make it possible for the employer to report monthly on *total* payrolls only, and quarterly, instead of weekly, on the earnings of each person on the payroll. Also, it will eliminate a very cumbersome process of computing benefits, and remove altogether the problem of properly defining a "week of employment" as a basis for determining eligibility for benefits. All things considered, it will reduce the reports of employers and the records of state commissions to a fraction of what is essential under existing requirements.

And it sacrifices nothing from the point of view of the insured worker. We have investigated it from various angles, and so far we have found no essential and significant difference in the results of the two systems, except that the irregularly employed worker who earns good wages when he works, will qualify for benefits on the basis of earnings much more easily than on a time basis.

If, then, we are searching for the minimum statistical requirements for effectively carrying out the major purposes of the social security program as this relates to unemployment, I suggest that we may well adopt the proposals now being made by the Social Security Board. As indicated, these would require of employers only a report of total payrolls once each month, and a quarterly report giving names of employees and earnings for the quarter. The state agency, likewise, would keep its records in terms of earnings by quarters. Benefits also would be computed on the basis of quarterly earnings and total earnings. This may not be reaching the goal of minimum requirements at a single bound, but it is undoubtedly a long step in that direction.

It should, perhaps, be mentioned again in closing that this is not a contention that we can deal with the problem of unemployment, merely on the basis of the information indicated. Unemployment Compensation is only a small part of any adequate program directed toward this end. Detailed information must be available in the employers' records. Undoubtedly this will mean some additional record-keeping by employers who have been negligent in this respect in the past. This should be required of all employers, not only of those who employ eight, or four, or whatever number is taken as the minimum for coverage under the state Unemployment Compensation act. A report of this information may be called for as needed, or may be required periodically if this seems desirable. This may be done by the same agency which administers unemployment insurance, or compensation, or by some other agency. The point I wish to stress in this discussion, is that the two functions should be considered separately, at least when we are discussing *minimum* requirements.

THE EMPLOYER'S PROBLEM IN SOCIAL SECURITY REPORTING*

By Christian E. Jarchow, *Comptroller*
International Harvester Company

The social security board has already registered about 45,000 employes of the International Harvester Company for participation in the benefits of the old age security plan. As we have an integrated business, our employes are engaged in a wide range of jobs. Our problems in connection with social security are, therefore, more complex than those of concerns which operate in a limited territory.

Recognizing at the outset the broad scope of the subject, we appointed a special inter-departmental committee made up of representatives of the following departments: Law, Manufacturing, Industrial Relations, Sales, Statistical, and Accounting. This committee considers all Federal and State social security legislation affecting the Company and its affiliates; develops plans for handling pertinent matters requiring attention; and advises and assists all persons in the general office, factories, sales branches, and other offices in complying with requirements of these laws.

Department heads are relieved as far as possible of these matters except on questions of policy and final approval of instructions.

Briefly, the general procedure is as follows:

(1) All social security legislation, including State unemployment laws, is analyzed by committee and copies of analyses are sent to interested department heads and to all operations affected thereby.

(2) Statistical information and reports requested by Federal government and states are cleared by committee before being filed.

(3) All tax returns, both Federal and State, are prepared and filed by general office from information furnished by factories, sales branches and other points of operation.

(4) Accounting Department issues full instructions to all operations in Company concerning proper method of handling the taxing or contribution provisions of Federal and State laws and sends out information relating to records and reports.

(5) The tax is paid by general office and absorbed by the respective operations as an item of cost.

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* A paper presented at a joint meeting of The American Statistical Association and American Association for Labor Legislation, Chicago, December 28, 1936.

Statistical requirements under the social security programs, generally speaking, comprise the following: Filing original applications of employer and employes; computing deductions from wages and payments to Federal and State governments; preparing periodical reports by Federal and State bureaus; and keeping permanent records by employers.

Filing of applications by employer and employes is completed at this time. Many employes have received their account numbers from the Federal government and presumably most of them will have been issued by January. The employer is charged with responsibility of ascertaining and recording account numbers of all employes. If an employe has not filed his application by June 30, 1937, the employer must do so. When new employes are hired hereafter, it will be necessary for employer to file an application form SS-5, unless such new employe has previously done so—in which case his account number must be ascertained and recorded.

Many companies find it necessary to change their employment records as a result of employes not using their legal names. Numerous employes have requested that their age be changed on the employment records to conform with that reported to the government.

Generally speaking, compliance with Federal and State social security laws will not necessitate setting up new or special records. Our current records with some modifications will provide the information required under these laws. The records are as follows:

(1) *Employes' Record Cards of Service and Earnings.* The cards will show employe's Federal Social Security account number, State number, if any, wages and all other details required under Federal and State social security legislation. They will be kept at each of the various operations.

Since only the first $3,000 of an employe's earnings from one employer during any calendar year is subject to tax, earnings must be accumulated on employes' earnings cards. Such record is also necessary in determining unemployment taxes under certain State laws.

(2) *Pay Rolls.* These forms are being revised and, in addition to customary pay roll information, will show Federal account number for each employe, period of service covered by each payment and amount of employe's tax and other deductions withheld or collected with respect to such payment.

Regulations require employer to furnish employe statement of tax withheld from his wages. This may be shown on pay envelopes or pay roll checks or by supplying special statement to employe showing deduction made.

(3) *Monthly Reports from factories, sales branches and other locations for Federal Old Age Benefit Taxes.* These reports will be required beginning January, 1937, to show total wages, wages exempt from tax, amount of tax withheld from earnings of employes, and employer's tax. Tax of employer and employe to be paid to Collector of Internal Revenue each month. The law requires that all operations of one company be consolidated in one return and filed with Collector of Internal Revenue in district in which principal office is located. Two or more affiliated companies cannot consolidate their returns.

(4) *Monthly Reports from factories, sales branches and other locations for Federal and State Unemployment Insurance Tax.* These statements show gross wages, gross Federal tax, credit for State tax, if any, to apply against Federal tax, gross State tax, if any, and net amount of Federal Tax. These reports also list required employment statistics. At some points of operation, particularly sales branches which have territory in two or more States, the information is reported separately for each State.

(5) *Quarterly Reports from factories, sales branches and other locations for filing information returns under Federal Old Age Benefit Plan.* First reports will cover period January 1st to June 30th, 1937, and subsequent reports will be submitted quarterly. In view of the large number of employes and the fact that an individual information return will be required for each employe, we shall distribute the work of preparation to each point of operation.

Old Age Benefit taxes are based on first $3,000 of wages earned from each employer in each calendar year. That is, if an employe has more than one employer in a calendar year, first $3,000 of wages earned from each employer is subject to tax imposed on both employer and employe.

Unemployment insurance laws have been enacted in 29 states, including District of Columbia (up to December 24, 1936). Federal unemployment tax applies to pay roll in all States—even though a State may not have an unemployment insurance law.

The return for the year 1936 is due January 31, 1937. The tax, however, may be paid in quarterly installments on January 31st, April 30th, July 31st, and October 31st. Each company may take as a credit (not to exceed 90 per cent of Federal tax) against the tax accumulated amount of contributions paid by it to States having unemployment insurance laws approved by the Social Security Board. All State unemployment compensation laws, except some of the most recent ones, have been approved by the Federal Board.

There is lack of uniformity in statistical information and tax returns required under the various State unemployment insurance laws. This is troublesome to an employer operating in more than one State and particularly to those companies having employes in many States. Presumably, as time goes on, an attempt will be made for greater uniformity among the States.

An additional problem to the employer is the modification of Industrial Relations plans which overlap benefits provided in the Social Security Act, especially in the case of those companies having pension plans. To avoid the assumption of a double liability with respect to the cost of future pensions, these companies must terminate existing plans or modify them in such a way as to supplement the benefits obtainable under the Social Security Act.

STATISTICAL REQUIREMENTS OF SOCIAL SECURITY PROGRAMS*

DISCUSSION

In view of the fact that the combined State and Federal Social Security laws represent a stupendous undertaking in their application, it is urged that every effort be made to keep the laws as simple as possible, even to the point of being arbitrary for the present, so as to minimize the number of items that have to be reported by employers and posted and recorded by the State and Federal administrative bodies. Laws along the type of the Connecticut and Michigan unemployment laws are far superior in this regard to those of the New York and Wisconsin Type, because the Connecticut and Michigan laws utilize the Old Age Benefit Reporting System as the basis upon which the State Unemployment Compensation law is developed.

It may be objected that simplicity in reporting may interfere with research progress. It is urged, however, that at the present time all necessary research can be done on a sample basis only, with the cooperation of employers voluntarily. Most employers will be glad to cooperate in any constructive studies and there should be no difficulty in any State getting the cooperation of a sufficient number of employers for such studies.

It is also urged that the problem of classifying employers and labor should be carefully studied for a long while before any decisions are made on the classifications to be used.

There are four ways of classifying an employer's business—first, by the processes he employs; second, by the raw materials he uses; third, by the products he produces according to trade names or, fourth, according to the trade channels in which he operates. Thus the problem of classification is a multiple and not a simple one and any arbitrary distinctions which disregard these generic or functional classifications of economic activity are bound to result in invalidity of data, with gross inaccuracies which exist in the Census of Manufacturers.

Professor Bigge expressed a belief that merit rating is too complicated to become practical because of the statistical work involved and, furthermore, expressed a belief that it will fail of its purpose, namely, to furnish an incentive for employers to do what they can to stabilize their employment. I strongly dissent with this position. In the first place, it is possible to set up merit rating systems so that they are simple from a statistical point of view. In the Michigan law, we have eliminated most of the statistical complications in merit rating by providing that an employe's benefits shall be charged against the account of the last employer, thus eliminating charge-backs to prior employers. This is sound in principle because once an employe has left the employment of a given employer and has obtained employment with another employer, there is no reason why the merit rating of his prior employer should be affected one way or the other by subsequent unemployment. In the second place, the only defense for payroll taxes basically is to make the cost of unemployment compensation an industrial cost and, therefore, a part of the price system so that the price of the product will consist of varying charges, depending upon the unemployment experience of the firm or industry manufacturing that product. The prices of houses and automobiles must contain a sufficient element of such costs for unemployment compensation purposes so that the public whose buying habits produce the wide cyclical fluctuations in these industries will pay for the burden which this places upon the community. On no other basis can payroll taxes be justified. If the contrary view is taken that nothing can be done about the problem of unemployment (in spite of the fact that many concerns and some industries have shown that a lot can be done about it) and thus that unemployment is simply a residual social cost, then under no circumstances are payroll taxes justified for financing unemployment relief but, on the contrary, such relief should be financed solely by graduated individual income taxation. Without merit rating, therefore, the whole theory of payroll taxes to support unemployment compensation breaks down. Merit rating grants no favors to any employer. It simply provides that the taxes will be somewhat in proportion to the risk exactly in the same way that is done in determining fire insurance rates by cities and types of dwellings.

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* The three papers preceding and the discussions that follow were presented at a session on this subject at the Ninety-eighth Annual Meeting (in joint session with the American Association for Labor Legislation).

With merit rating simplified statistically, there remains no reason why it cannot be made effective and furnish a strong inducement to the individual employer to do his best to improve the unemployment experience of his own employes.

STEPHEN M. DUBRUL

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DISCUSSION

The research aspects of the statistical data required in social security may be summarized briefly under three main heads: First, the basic data must necessarily be governed in large measure by administrative considerations. Research needs must be kept in mind and must be met within reasonable limits. On the other hand, success of the program which has actually been established may depend to a considerable extent upon simplicity of administration. Therefore, research workers must be content to remain in the background, adapting their needs to the possibilities that may remain open after major administrative problems have been met.

Secondly, however, there is need for emphasis on the fact that statistics cannot always be obtained as a by-product of accounting—in other words, as a by-product of the administrative process. To the extent that such a relationship can be established, the research worker may find materials ready-made for him; but there cannot be complete reliance on this source, for there are certain types of data which must be obtained from the outside if intelligent appraisal of administrative policy is to be made.

Thirdly, a comprehensive research program must be built upon a combination of sources of data. Within the Social Security Board, for example, the following three types of data are being developed: (a) current reports on a regular monthly basis—for major items such as number of employees, amount of payroll, kind of industry, and place of employment; (b) periodic reports at intervals of six months or a year—for subsidiary items such as classification of employees by age, sex, or individual earnings; and (c) special reports on a sample basis—for such data as length of unemployment, amounts of individual benefits, or shifts of workers from place to place and industry to industry.

Current reports should come through the accounting process, and statistical methods are being devised which will yield current data with a minimum of extra time and money. Periodic reports should flow largely from accounting procedure, but special tabulations and year-end summations will always be necessary in addition. Special studies, which are the most costly of all and the least adaptable to the routine of administration, frequently constitute the heart of a research program. Since speed and flexibility are essential if such studies are to serve administrators as guides to policy, the sampling technique has to be widely used. The possibilities of such a technique have already been explored in other fields by research workers. In the Social Security Board research program a further extension of such methods will be attempted.

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ANALYZING FAMILIES BY COMPOSITION TYPE WITH RESPECT TO CONSUMPTION*

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THE CURRENT Study of Consumer Purchases[1] was planned primarily to furnish basic data concerning the consumption patterns of families of the United States. A family's consumption is affected both by its income and by the number of persons for whom the income must provide; hence classification by family composition has been part of the plans from the inception of the project.

In the collection of expenditure schedules, the controlled sample has been restricted to seven family types, as follows:

1. Husband and wife, and no other persons
2. Husband, wife, 1 child under 16, and no others
3. Husband, wife, 2 children under 16, and no others
4. Husband, wife, 1 person 16 or over, and one or no other persons
5. Husband, wife, one child under 16, one person 16 or over, and one or two other persons regardless of age
6. Husband, wife, 3 or 4 children under 16, and no others
7. Husband, wife, at least one child under 16, and 4 or 5 other persons regardless of age.

These types are used as units for the analysis of data relating both to income and to consumption. Number and (to a limited extent) age of persons in the economic family are the basis for these types. Each represents a somewhat homogeneous group within which considerable variation is possible. Since these seven types represent approximately 96 per cent of the native white families in the random sample taken in small cities and villages and 93 per cent of the random farm sample, they are representative of the great majority of the nation's families. It is obvious, too, that any scheme for classifying so large a number of families in only seven groups must admit of some variation within each group.

From the standpoint of methodology of consumption studies the following questions should be considered:

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 30, 1936.

[1] Plans for analyzing families by types, discussed in this paper, represent the work of the four Federal agencies cooperating on this project: The National Resources Committee; the Bureau of Home Economics, of the U. S. Department of Agriculture; the Bureau of Labor Statistics, of the U. S. Department of Labor; the Works Progress Administration; and the Central Statistical Board.

Of what value is classification of families by composition type in analyzing consumption data?

What are the alternatives to this method of classification?

Upon what basis were these specific family types chosen? What are their merits? Their shortcomings?

Does experience, to date, indicate that use of these specific types in future studies is desirable?

The classification of families by composition type adds significance to any analysis of consumption by income. Everyone familiar with expenditure studies where all families have been grouped together by income, regardless of family composition, would agree that attempts to interpret findings were highly unsatisfactory. Two families, one of two members and one of seven, each with an income of one thousand dollars, cannot be considered as living at the same economic level. Classification by type permits analysis of variations in expenditure patterns of families of different types, when income, occupational group, degree of urbanization and area are the same. This scheme of classification also enables the investigator to hold the factor of family composition fairly constant, and thus obtain increased clarity in observations of variations in family expenditure patterns with variations in other factors, such as socio-economic status or residence in city or village.

Granting these values of classification of families by type, one may ask whether this method is preferable to other possible methods of differentiating families according to composition. The most important of such other possibilities are: Classification by number in family, regardless of age; by income or expense per consumption unit; by per capita income or expense (a method closely related to the preceding but less exact); by stages of the family life cycle.

Classification by number in the family is far better than no classification. In some previous studies where selection of families has been rigidly limited (as to those having children under 16 and none older), classification by size automatically provides types. In this project where there has been less limitation of family composition in order to obtain a more representative sample of the population, classification by number of family members regardless of age seemed inadequate.

The next alternative is determining family size in terms of "consumption units" of some sort and classification by expense per unit. These units, supposedly, stand in the same relation to one another as does the consumption of the different family members. The use of units for analysis of family expenditure data was initiated by Engel. His unit, the quet, was based upon the assumption that the expense incurred for the child from the time of its birth to manhood increased by approximately the same amount each year. According to his scale, the new born babe was equivalent to 1.0 consumption (cost) unit; the man 25 years of age, to 3.5 units. Subsequent research workers have formulated other scales, most of which have used the consumption of the adult male (rather than that of the infant) as the unit.

Among earlier investigators, there was some confusion between scales based upon relative expenditures for individuals, consumption (cost) scales, and those based upon bodily needs, such as nutrition requirements of persons of different age and sex, consumption (nutrition) scales. Now, however, cost-consumption scales are recognized tools for analysis of family expenditure data.

Cost-consumption scales for analysis of expenditures for items of family living consumed individually (as food and clothing) are more successful than those for analysis of housing and other goods consumed on a family basis. A composite cost-consumption scale for all goods and services, based upon relative expenditures for the food and clothing of family members and upon per capita expenditures for other items, has been formulated and is being used by Dr. Faith M. Williams in analyzing money disbursements of wage-earners and clerical workers.[2] Classification of families according to expense per consumption unit (as determined by this scale) represents a great advance over classification by per capita expense since it takes account of differences in costs of food and clothing with differences in sex and age. Such a method of classification is well adapted to the main purpose of the investigation for which it was used—the revision of the cost-of-living indexes of the Bureau of Labor Statistics.

For the present Study of Consumer Purchases whose primary purpose is to depict the consumption patterns of the population, the use of a cost-consumption scale seems less well adapted. Presentation of data concerning *family* consumption of housing, radios, and many other goods and services is a more realistic method of showing the consumtion patterns within a farm area, or a city than is presentation of data by "equivalent adult males." Estimates of community consumption can be made by weighting the data from families of specific types according to their frequency in the community. Furthermore, the family schedules used for this study furnish important information concerning family income, number of earners per family, their age and their earnings, and the burden of family support—all of which must be analyzed on a family basis to be of maximum value.

However, the use of family types as a basis for analysis of consumption data does not preclude the concurrent use of cost-consumption scales. Such scales will be used in our analysis of expense for food and clothing. Thus, figures showing annual expense for food for a family of given type, income level, and occupational group will be accompanied by figures for expense per meal per food-cost-unit for the same family. It seems possible, by such a combination, to utilize the advantages and minimize the disadvantages of the two methods of classification.

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[2] Faith M. Williams, "Money disbursements of wage earners and clerical workers in 11 New Hampshire communities." *Monthly Labor Review*, March 1936, Vol. 42, pp. 554–563.

Classification of families by stage of their life cycle must be accompanied by some classification by size, to obtain a clear-cut analysis of family consumption. This then becomes a sort of classification by type, once stages are defined in terms of ages of children and parents. Family types 2, 3, and 6 of this project[3] are clearly in the early and middle stages of their life cycle. However, families of types 1 and 4 may be in any stage; the third adult in the latter type may be the parent of a young husband and wife or may be the grown son of an elderly couple. A further break-down of the family types used would be highly desirable, not only to shed more light upon changes in consumption with changes in the family life cycle, but also for many other purposes. However, limitations of time and money made limitation to seven types imperative for sample control and preliminary analysis. Further breakdowns may follow later.

This variation within type and consequent clouding of many details of consumption is one of the main criticisms of this scheme of analysis. However, with limited funds the number of family types for analysis must be limited also. Choice then lies between very narrowly defined groups representing a small portion of the population, and broader groups representing the majority of families. For the picture of consumption desired from this Study, the latter course seemed better. For another purpose, fewer types might be preferable.

The use of the age 16 (rather than 14, 18, or 21) in type classification may be questioned by some. However, the clothing and recreation consumption of the child of 16 is approximately the same as that of a young adult. In addition, in many states school attendance is compulsory until children reach this age and child labor laws refuse them employment. Hence, from the standpoint of contribution to family income and the burden of family support, this age classification seemed desirable.

In recommending types to be used in future studies, experience seems to indicate that type 7 might be dropped in urban areas if funds are limited. This type constituted only 3 per cent of the random sample in the small cities of the Northwest. Much time and money was spent in trying to obtain the number of such families desired for the controlled sample. There would be less justification for dropping this type in farm areas where large families are more prevalent. The social worker and the educator would be loath to see this type dropped, since it is the large family rather than the small which has the most difficulty in making ends meet with a limited income.

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[3] See p. 35 for description.

In any large-scale research project, the by-products—the data which can be used for purposes other than those for which the study was primarily planned—are a valuable contribution. The classification of families by types throws light upon the differences in composition of families in different occupational groups and income groups. For example, such analysis as has been made, to date, seems to bear out Rowntree's theory that the urban family passes from a period of limited income in the beginning of its life cycle, through a more prosperous period, and back again to limited income, with old age. (This seems less true of farm families.) In the small cities of the Northwest the peak of the curves showing distribution by income of families of types 1, 2, and 3, falls in the income class $1,000–$1,249. For family types 4 and 5, each with at least one potential earner (16 or older) in addition to husband and wife, the peak of the curve falls in the income class $1,500–$1,749. Classification of families by type for the presentation of data concerning number of earners per family also will help answer questions concerning the burden of family support carried by the principal bread-winner. Numerous other examples of valuable by-products of information from type classification could be made.

To summarize: For research directed toward depicting consumption patterns of communities and areas, the family seems to be the most desirable analysis unit since it is the most important consumption unit. Because there is so close a relationship between family composition and consumption, it seems essential to differentiate between large and small families, familes having young children and those composed chiefly of adults. The seven family types used in the current Study of Consumer Purchases are representative of those most commonly found in our population and therefore representative of frequent consumption units.

DISCUSSION (See page 46.)

METHODS OF MEASURING VARIATIONS IN FAMILY EXPENDITURES*

By Faith M. Williams[1]
U. S. Bureau of Labor Statistics

The study of consumption bristles with problems of methodology. It is, in fact, a study of our entire economic order from an angle which is only just now becoming familiar to the economist. The recent depression has made a large number of people aware of the fact that we need to know much more than we do about consumer demand, and has emphasized our ignorance of the factors causing variations in family expenditures.

Most statistical studies of family expenditures have been analyzed so as to provide average expenditures at different income levels with no measurement either of variations in expenditures, or in the types of families represented at each income level in the sample studied. In recent years the reason for this limitation of the analysis has been, I am quite convinced by discussion with research workers in this field, lack of funds. The difficulties of sampling in family expenditure studies, and the very considerable expense involved in *securing* the data have in most cases exhausted the funds available from government agencies and foundations before the analysis of variance was begun. Ogburn, Canan, and Muse in the United States and Bowley and Allen in England have some published material on variations in expenditures. The Bureau of Labor Statistics, the Bureau of Home Economics, and the National Resources Committee have unpublished data on the subject.

The very extensive material on the family expenditures of wage earners and clerical workers gathered by the Bureau of Labor Statistics in the District of Columbia in 1916, and in Philadelphia in 1918 was subjected by Professor Ogburn to a correlation analysis to show how family expenditures in these two cities changed with changes in income and family size. The families selected for the analysis included only white families living in rented houses, without lodgers or boarders other than children living with the parents. Size of family was measured in terms of the equivalent adult male scale used by the Department of Labor until recently as a measure of the demand for food. In this scale a man equals 1.00, a child 3 years old or less 0.15, and women

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 30, 1936.

[1] The author is indebted for assistance in the analysis to Gertrude Schmidt Weiss, William C. Shelton and other members of the staff of the Cost of Living Division of the Bureau of Labor Statistics.

and older children fractions in between. This analysis produced some very interesting results, but their value is impaired by the general lack of confidence in the scale used for measuring family size, as a satisfactory general index of consumer demand.

At the present time the Bureau of Labor Statistics in its study of the expenditures of wage earners and clerical workers is using a composite method of measuring family size. This method involves the use of three different scales finally combined into one measure of consumer demand, which is being called a consumption unit. The scale measuring relative demand for food is based on the Bureau of Home Economics estimates of the cost of food actually consumed by individuals of different age and sex in urban families of low and moderate income; the clothing consumption scales are based on the actual clothing expenditures of the families concerned in six different regions of the country. The third measure used for the remainder is the equivalent number of persons dependent on the family income for a year. These three measures of family size are divided into the expenditures of the given family for food, clothing, and other items, and the three quotients summed to give total expenditure per consumption unit. The total number of consumption units in the family can be obtained by dividing the expenditures per consumption unit into the total family expenditures. This composite method of measuring consumer demand is at best an approximation to a more accurate method which can be developed with correlation analysis from the very extensive material on consumption being made available through the research now in process. Classification of families by expenditure per consumption unit depends both on amount of income and the number of persons dependent on the income. For example, a family of two adults, a father in factory work and a mother at home, and two children, with an income of $1,500, may save $50 during the year, spending $1,450 for consumers' goods, and will have relative freedom in spending, at a level of $401 per consumption unit. On the other hand another family with an income of $1,500, but with eight members, including a father in factory work, a mother at home, a sister in clerical work, and five children, also saving $50 in the year and spending $1,450 for consumers' goods, will be considerably cramped in its spending at a level of $208 per consumption unit. In the twenty cities for which figures are now summarized it has been found that there is a steady increase in average family income with increase in expenditure per consumption unit, and a steady decrease in average family size.

Material has recently become available on differences in the distribution of expenditures by families of employed wage earners and clerical workers in New York City at different levels of expenditure per consumption unit. These materials show the percentage of total expenditure going to food, declining steadily and rapidly with increases in the expenditure level of the families studied, from 45.6 per cent at the lowest level to 30.3 per cent at the highest. The percentage going to housing and household operation declines slowly and irregularly. On the other hand the percentage allocated to the purchase and operation of automobiles increases very rapidly with increases in the expenditure level from 0.2 per cent at the lowest level to 4.1 at the highest. The percentages spent for furnishings and equipment, medical care, and recreation also increases, but not so strikingly. The percentage spent for transportation other than by automobile, and for personal care have a very stable relation to total expenditure, the one taking about 3.3 per cent of the total and the other about 2.0 per cent. One of the most interesting pieces of information brought to light by this method of classification is the change in expenditures for medical care with change in economic level as measured by change in expenditure per consumption unit. At the lowest economic level for which the data have been summarized, average expense per person for medical care of all types was $4.70 a year and at the highest level $40.97. All medical expenses *incurred* in the period covered by the schedule are included in the figures just quoted whether or not they were paid within the period. The figures on the amount of services received from doctors in home visits and office visits show similar increases and indicate that only a part of the larger payment per person can be attributed to the higher rates charged by this profession to the more affluent. On the other hand, average expenditure per clinic visit varied from $.28 at the lowest economic level to $1.05 at the highest, and may indicate a graduation of fee in relation to ability to pay. No information was secured on the amount of medical care received without any money charge by the families included in the sample.

The fact that the Bureau of Labor Statistics' investigation of the family expenditures of wage earners and clerical workers was undertaken for the purpose of providing new weights for the Bureau's indexes of living costs has made it necessary to give priority to the computation of average expenditures such as those just cited. The analysis of variations is a second stage of the study which is just now getting under way. The computation of standard deviations has gone far enough to show how very great are the variations in expenditures at given income levels of families of given types as we have classified them. Perhaps life in American cities presents a wider range of possible living arrangements to the families of employed wage earners and clerical workers than many people predicted when we began this study. However, we may discover that we need for our analysis finer classifications by family type. Perhaps we must distinguish not only families of "husband, wife and no others," but "families of husband and wife, both working," and "families of husband and wife, husband working." We may need to classify families of given composition by age of husband and wife, and by age of children, separating families with all children under school age, all children in grammar school, and all children in high school. Such a classification would enable us to establish representative expenditures at different periods in the life cycle of the family. The more the data from this investigation become available, the more I am impressed with the similarity from one city to another in the movement of the average consumption pattern from one expenditure level to another, and in the diversity of the consumption pattern of families of different type at given economic levels.

It is possible to select from the 1,000 families of employed wage earners and clerical workers studied in New York City, three controlled samples of 60 families each, all the samples restricted to families with homemakers born in the United States, each sample restricted to one family type, and each sample having an equal number of cases at each income level. The influence of income having been held constant in this way, it should be possible by comparing the figures from three samples to analyze the influence of family type on spending. The first step in the process is to compare coefficients of variation for different groups of items. The three family types chosen for this special analysis are as follows:

Families consisting of husband and wife only;
Families of husband and wife and one child;
Families of husband, wife and two to four children.

These figures show that the increases in expenditures for food and housing with increases in family size are obviously not large enough to provide food and housing for the larger families at the same level as for the smaller ones; average expenditures for personal care and medical care per family decrease slightly but average expenditures for these items per person decrease markedly with increase in family size. Expenditures per family for recreation and for transportation decrease greatly with the addition of children, but not so rapidly as average expenditures *per person* for medical care.

If the groups of items covered in Table I are arranged by the size of their coefficients of variation, food, housing and household operation are found to be among the lowest four for each family type; transportation and medical care among the highest three for each family type. Variations in transportation expense depend largely on whether or not the family has an automobile, and in medical care on the incidence of actual illness, as families at this income level do not spend much for preventive medicine.

The very high coefficients of variation for clothing expenditures may be due in part to the fact that these samples include both wage earners and clerical workers. The clothing standards of these two groups may be different enough to account for the wide range in expenditure for raiment by families of given type with the same income.

TABLE I

AVERAGE EXPENDITURES FOR ONE YEAR WITH THEIR COEFFICIENTS OF VARIATION: FAMILIES OF THREE DIFFERENT TYPES (SAMPLES CONTROLLED FOR INCOME), EMPLOYED WAGE EARNERS AND CLERICAL WORKERS, NEW YORK CITY, 1934–36*

Groups of expenditures	Families of husband and wife only		Families of husband, wife and one child		Families of husband, wife and two to four children	
	Mean expenditure	Coefficient of variation	Mean expenditure	Coefficient of variation	Mean expenditure	Coefficient of variation
Food	$541.50	20.7	$589.80	19.6	$657.50	7.6
Housing	365.80	21.2	368.90	23.4	375.20	21.0
Household operations	145.50	29.9	135.80	22.3	149.50	27.7
Recreation	119.70	48.0	106.60	41.0	92.70	28.2
Personal care	32.00	26.9	31.00	43.2	29.90	30.8
Medical care	61.90	48.0	61.30	53.3	57.90	39.7
Transportation	111.60	79.5	71.50	42.9	62.20	44.0
Clothing	161.80	47.4	178.30	38.1	146.90	79.0

* Mean expenditures are computed to the nearest ten cents.

It is of some interest to compare the large size of these coefficients of variation with similar figures from the study of the expenditures of three groups of Federal employees made in cooperation by the Bureau of Home Economics and the Bureau of Labor Statistics in the fall of 1933. Similar data are available (1) for families of male employees in the professional service with incomes averaging about $3,200 including families of husband and wife only; husband, wife and children under 16 years of age; and husband, wife and children under 16 years of age with others: for (2) families with the father in the clerical service with incomes averaging $1,700 and including the same family types as the families of professional workers; and for (3) families with at least one member in the clerical service, consisting of husband and wife only, both employed, family incomes averaging $3,500.

When the groups of expenditures for each family type as defined in the study of Federal employees are arranged in rank order according to size of their respective coefficients of variation, the arrays for the three samples are, with one exception, identical. The lowest variation is in food expenditures: housing, clothing, household operation come next. Variations in expenditures for personal care are about twice as great as in food, and except for the professional employees, expenditures for recreation vary still more. In all three of these groups as among the New York wage earners and clerical workers, the highest variations are found in expenditures for transportation and medical care. Tests of the skewness of the expenditures of the professional employees for these groups of items show a moderate degree of skewness for all except food. The skewness of housing expenditures is most marked, and further analysis of these figures is in process to separate housing expenditures of home owners and renters whose rental payments include heat and those whose rental payments do not include heat.

TABLE II

AVERAGE EXPENDITURES FOR ONE YEAR, WITH THEIR COEFFICIENTS OF VARIATION: FAMILIES OF FEDERAL EMPLOYEES OF THREE DIFFERENT TYPES, WASHINGTON, D.C., JULY 1, 1932 TO JUNE 30, 1933

Groups of expenditures	Families of Federal employees in—					
	Clerical-Administrative-Fiscal Service $1,500–$1,999 basic salary				Professional service, $3,000–$3,999 basic salary, male, sole support of wife, with or without other dependents	
	Male, sole support of wife, with or without other depedents		Female, with employed husband and no other members in family			
	Mean expenditure	Coefficient of variation	Mean expenditure	Coefficient of variation	Mean expenditure	Coefficient of variation
Food	$408.56	21.70	$617.09	24.55	$665.46	30 28
Housing	447.09	35.76	557.63	29.55	593.91	33.40
Clothing	143.43	35.99	333.98	38.53	287.82	43 01
Household operations	180.78	41.77	278.00	44.07	357.77	47.83
Personal care	27.21	46.34	67.03	48.49	45.29	45.35
Recreation	65.83	56.27	153.16	60.96	137.47	48.45
Transportation	106.93	63.99	308.82	84.92	266.24	74.85
Medical Care	62.48	87.53	125.98	94.91	166.79	91.07

The very large variation in expenditures of families of the types distinguished in the study of Federal employees made it seem advisable to define family types somewhat more narrowly in the study of employed wage earners and clerical workers. In the study of wage earners and clerical workers, however, no sampling device was available which made it possible to control the sample, either according to income, or family type and the number of cases available at any given income level is not so large in the more recent wage earner investigation as in the Federal employees study.

The high variability of the family expenditure data with which we are dealing makes it necessary to use a very sensitive measure for the analysis of the significance of the differences between the mean expenditures of families of the same income, but different type. On that account, with the data from the three samples of New York City wage earners and clerical workers described above, we have used Fisher's z test. Means were computed as follows for the expenditures for each group of items as follows:

1. The mean expenditure by families of each of the three types at all the income levels included in the three samples.
2. The mean expenditure by families of each type at each of eight income levels (i.e., 24 means).

Deviations of the expenditure of individual families from the mean expenditure for the income group and family type to which they belong were squared and summed, and an estimated standard deviation computed based on 156 degrees of freedom. Another estimate of the standard deviation was computed from the deviations of the means for each of the three family types from the mean for all family types based on two degrees of freedom. The natural logarithm of the ratio of these two standard deviations is "z." Fisher has published tables showing the values of z which will be exceeded 5 times in 100 and 1 time in 100 if there are no significant differences among the groups, in our case between the expenditures of the three family types. Using this method, the differences between the expenditures of the different family types for food are found to be significant; the larger families spending more for food than smaller families of the same income class. The difference between the larger and smaller families with respect to expenditures for transportation is also statistically significant. The distribution of expenditures for medical care is very far from normal and the test may not be a very good approximation in this case.

DISCUSSION

It does not matter particularly that the papers just read were not available before the meeting. The ideas of these authors in regard to family expenditure studies are fairly well known from the way they have gone about the investigations under their supervision. I am greatly disappointed not to hear Miss Kneeland's paper[1] on "Design and Purposes" for it seems to me especially important to thresh out the matter of the fundamental purposes of these relatively expensive and difficult studies. Many people for many purposes of their own may make use of the published results and find them to varying degrees satisfactory. But it seems to me that those planning these investigations whether large or small should have clearly in mind their own major purpose or purposes, should relate their procedures of collection and analysis to this purpose and expect or invite criticism on the success with which they attain it. They might well, it seems to me, ask themselves what purposes one can achieve by these studies, and to what degree one can achieve a specified purpose. They should also ask how many different purposes can be satisfactorily attained by the same study. In justifying one's works, especially when large sums of money are involved and the cooperation of diverse groups of people is desired, there is a tendency to make large promises. The studies will, it is said, take the guess-work out of business, show families how to make ends meet, serve as a basis for planning by the state and by industry, disclose inadequacies in income and in consumption choices, enable us to revise our cost-of-living index, set up norms for the construction of standard budgets and disclose the "laws of consumption."

The moral issue raised if these promises are unredeemable does not concern us now, but the situation that results if the alleged purposes are irreconcilable, if they confuse the investigators in planning procedures of collection and analysis, does concern us. There is the possibility that an all-purpose study satisfactorily achieves no purpose. At any rate I repeat that there is nothing pertaining to an expenditure study that could be more profitably considered than its avowed purpose or purposes. Judging from many studies made in the past those conducting them could profitably have reviewed Bowley's statement of the three purposes of all scientific statistics: establishment of averages, description of variations and solution of problems of causation.

It has seemed to me that in design and procedures the wage-earners' study planned by Miss Williams as a necessary step in the revision of the cost-of-living index of the Bureau of Labor Statistics and this later, more comprehensive, nation-wide study in which both she and Miss Monroe have had a part move us definitely into our third epoch in the history of such studies. The first period was that of the latter eighteenth and early nineteenth century beginnings, the second dates of course from Engel who first made the statistician's approach to the problem and conceived of the purpose as that of discovering whether uniformities existed that might be called "laws." As a statistical problem these current studies mark the beginning only of the second period, the first distinct advance since the work of Engel.

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[1] Illness prevented Miss Kneeland from reading her scheduled paper. [Ed.]

It is true of course as with all other epoch-making events that here and there in smaller studies and in critical discussion there have been indications of an understanding of the nature of this problem so that it was fairly certain that once funds were available and under the control of the proper persons we would see this distinct advance. One could name names and cite references but this is not a history.

Why, one might ask, have we waited seventy years to make a distinct advance beyond Engel? It is not, as some too quickly have said, that this field has been unexplored in the sense that few studies have been made, no data collected. The publication of the Zimmerman and Williams bibliography rather definitely put the quietus on this idea. Looking at that volume, the old tendency to say, "Let's make a study," gives way to the question, "Why do we know so little after we have made so many studies?"

Our backwardness may of course be partially explained in terms of the development of statistical method. As new techniques for analysis are developed and commonly understood they are increasingly utilized whenever quantitative data are collected and analyzed. But I think our fundamental difficulty lay in our lack of clarity with reference to the purpose or purposes for which we were collecting and analyzing these data. One might summarize what was necessary for advance in this field as follows:

1. A clear understanding of the various purposes for which such studies should be undertaken—and for which they should not be.
2. A willingness to concentrate upon a single purpose.
3. An understanding of the relation between purpose and techniques.
4. A transfer of emphasis from collection to analysis.
5. A command of the techniques appropriate for collection and analysis.

The major purposes for which data on family expenditures may be collected should be differentiated one from the other since each sets up its own requirements for sampling, planning the schedule and analysis. One such possible purpose is to secure the data necessary for constructing or revising a cost-of-living index. In a paper read at these meetings three years ago Miss Wright raised various questions in regard to the requirements for such studies. Closely related, but to be differentiated is the study that aims to be purely fact-finding—to secure a record of what families of a city or region are buying or using—in other words, to discover those consuming habits which cannot be deduced from other data available as that on production, sales, imports, exports, etc.

Still another distinctive purpose is to disclose deficiencies in the families' command of essential goods and services and to discover the points at which those deficiencies appear. This is one of the oldest and probably the most frequent of the avowed purposes for which such studies have been undertaken. Obviously, however, to accomplish this purpose the investigator has a dual problem, that of securing his data and that of selecting his standards for appraisal. The second has all too frequently been ignored or most imperfectly considered.

Finally, as an objective of these studies is the discovery of factors that control consumptive choices and the relative power of each. As Lively puts it, it is to determine the internal laws of budgetary organization and variation and to explain budgetary behavior in terms of associated, non-budgetary variables. This objective has least frequently of all been elevated to a major position and the techniques adopted that would attain this end. I call the study for which those asked to participate in this meeting are responsible epoch-making because this purpose was clearly conceived and the study admirably planned to promote it. If the analysis of the data collected can be made as intelligently and thoroughly as the collection we should know vastly more about the laws of consumption than we have hitherto known.

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MEASUREMENT OF EFFECTS OF RECIPROCAL TRADE AGREEMENTS*

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The united states has now made some fifteen trade agreements with other countries under the authority of the Trade Agreements Act of 1934. Over half of these agreements went into effect on or before January 1, 1936, and two others went into effect early in this year. Already, mostly on the basis of statistics for unduly short periods of time, there has been much controversy as to the actual influence these agreements have exercised on the volume of trade. When trade figures for 1936 as a whole become available, they will furnish a more nearly adequate basis for studying those effects.

Those Federal officials who have been active in the framing of trade agreements naturally await these fuller statistics with interest, not to say anxiety. They know that most persons, whether predisposed in favor of or against the tariff-bargaining program, will judge its utility largely on the basis of the changes in trade actually following the agreements. They have a keen curiosity to know whether the results which they had roughly forecast while working out the provisions of a given trade agreement, or which at least they had hoped might follow, have in fact taken place. Whatever may be the views of an American trade-agreement negotiator as regards the general issue of protection versus free trade, he must, in order to avoid widespread criticism, seek to obtain, from the foreign countries as a group, concessions at least equivalent in benefit to exporters to the concessions made by the United States. To accomplish this for the countries as a group each individual agreement must, in most cases, provide a large measure of such equivalence.

Imperfect as may be changes in exports and in imports to serve as a measure of the benefits resulting from concessions, they are the only measure capable of practical application in such a way as to be comprehended by the general public. Consequently the negotiator strives as best he can to forecast how the concessions asked and the concessions offered will affect the actual volume of trade.

Naturally such forecasts are more or less shooting into the dark. No one can foresee with any close approach to certainty how much a given reduction in a rate of duty will affect the imports of the product, even if no new causal factor in the importing or the exporting country interferes with the logical outcome. A reduction of 50 per cent in one rate, which is the maximum reduction the United States can make under the provisions of the Trade Agreements Act, may have less effect than a much smaller reduction in some other rate. Although the trade negotiating committees have before them practically all pertinent statistical information which exists concerning the various commodities under negotiation, this information by the nature of things can never be sufficient to permit accurate prognostication.

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It is of course necessary, when a trade agreement is first made public, for the Government to put out statistics of some sort bearing on the relative importance of the concessions granted and the concessions received. The obvious, if not indeed the only possible, thing is a table showing for some past year or years the value of the imports into the United States, from the other contracting country and from the world as a whole, of each import commodity affected by the agreement, and the value of the imports into the other country, from the United States, of each commodity on which a concession is obtained. These figures are combined into various group totals, distinction being made especially of (a) commodities on which duties are reduced, (b) those on which existing duties are bound against increase, (c) those the continued free entry of which is bound by the agreement, and (d) those on which the concessions (chiefly by foreign countries) relate to quotas permitted entry. In addition the effort has been made in some cases to compare the average percentages by which the rates of duty on the two sides have been reduced.

In computing both the value of the trade affected by concessions, and the average percentage of reduction in duties, much of course depends on the year or years selected as a basis for the data. For example, in the case of the trade agreement with Canada, import figures were given for the two years 1929 and 1934. On the basis of the reported imports of 1929 from Canada into the United States, articles on which the duties were reduced by this country under the agreement accounted for 16.6 per cent of the imports, whereas on the basis of the imports of 1934, disregarding whiskey, the proportion was only 7 per cent. Largely by reason of the increases in duties in the United States, there had been a much greater decline between 1929 and 1934 in the imports of the dutiable articles affected by the agreement than in the imports of other dutiable articles and of free articles. Whiskey, on which the duty was cut 50 per cent, must be disregarded in this comparison because there were no reported imports of whiskey in 1929 although doubtless large quantities were smuggled in. A similar though less marked disparity between the two years compared appears in the corresponding percentages relating to imports from the United States into Canada. So, too, the average percentage of reduction in duties by the Canadian agreement, if weighted at all, will appear considerably different according as weighted by the imports of these years respectively. Thus the reduction in the United States duty on cattle would have much influence on such an average if weighted by the imports of cattle in 1929, but would have very little influence if weighted by the small imports of 1934.

Turning now from the problems of prognostication to the problems of analysis of actual post-agreement trade statistics, we naturally find the latter the easier, but still far from easy.

This paper aims to discuss statistical methods and not economic principles or public policies. The economist need not be reminded that the effects of a change in imports of a given commodity, or of commodities in general, are many and complex. A statistician might well undertake, if the data were obtainable, to present, for each commodity on which the United States has reduced the duty by a trade agreement, statistics not only of changes in the quantity of imports but also of changes in the unit prices of the imported articles, in the prices of competing domestic products, in the output of the domestic industry, in its profits, and in the wages of the workers. It would remain for the economist to appraise the relative significance of the several changes disclosed by the data, to study the complex of causes (in large part not revealed directly by the statistics relating to the particular commodity itself) which have brought about these changes, of which the reduction of duty may be by no means the most important, and finally to form some judgment as to the magnitude of the total benefits and of the total injuries—if injuries there be—resulting from that part of the change in imports which can be attributed to the reduction in the duty. Unfortunately in the case of most commodities the statistician can provide by no means all the requisite data for such thoroughgoing analysis, and even if all the data were available the economist would find it hard to draw definite conclusions.

The difficulties above outlined arise even when only a single commodity is under consideration. To attempt to generalize concerning a large number of commodities as a group is to multiply the difficulties almost geometrically. As a matter of fact, from the practical standpoint about all that can be done as regards the general effects of a trade agreement involving any considerable number of commodities is to present, in adequate fashion, the statistics of the changes in international trade itself.

It should be borne in mind, however, that in the case of most of the trade agreements some of the concessions are such in nature that they have no tendency to increase trade, their purpose being rather to forestall possible measures which would decrease trade. I refer to bindings of existing duties against increase and bindings of continued free entry of specified commodities; the latter may relate to a larger value of trade than all other concessions combined, as was the case, for example, with the concessions of the United States to Canada. It is important that in considering the advantages or disadvantages of a trade agreement, due weight should be given to the values of such bindings.

In judging the significance of these bindings, it must not be forgotten that between 1930 and 1935 there was pretty much throughout the world a tendency toward higher trade barriers—toward smaller free lists, increased duties, and new and more severe quantitative restrictions. There is, of course, no possible method of calculating statistically the degree of probability that, in the absence of the bindings of the several trade agreements, unfavorable action affecting the commodities concerned would have been taken by our own country or by the other contracting countries. Still less is it possible to make any guess as to how greatly any unfavorable action would have reduced trade. The probability of injury to trade was doubtless small in the case of some of the commodities now protected by bindings, but with respect to others it was fairly large, if not very large.

The importance attached to bindings of free entry is well illustrated by the trade agreements with Brazil, Colombia, and Guatemala, the imports from all three of which are dominated by coffee, a free commodity. There was little room for concessions on the part of the United States with respect to dutiable commodities from these countries. Each of them, however, was willing to make important reductions in duty on American goods in exchange for the binding of the continued free entry of coffee, knowing that the imposition of a tax on coffee for revenue purposes was by no means improbable and that a tax might materially cut down the trade.

It should be noted in this connection that the true benefit of rate reductions and quota increases provided by a trade agreement may be greater than the mere difference between the old and the new rates or quota limits. In the absence of an agreement, rates might have been made still higher and quota limits still lower.

In assessing the results of any trade agreement, a majority of men in the street, and of men in high public places as well, will hold that—apart from the value to be assigned to bindings of existing customs treatment—the United States has made a good bargain if the increase in the exports of concession-articles has been greater than the increase in imports of concession-articles; the more thoughtful, of course, will have in mind that part of the increase which can be attributed to the concessions. Where the reverse situation appears the bargain will be considered a bad one, especially if the imported articles are competitive with domestic products. To be sure, there are many persons who weigh the results by different scales. One who has a strong leaning toward freer trade, on general grounds or merely because of the position of the United States as a creditor nation, may rejoice as much over an increase in imports as over an increase in exports—possibly even more. On the other hand, the extreme protectionist, viewing any importation of competitive articles as a direct injury to our national economy, may consider a trade bargain bad even if increase of imports is less than that of exports. Some prophets of isolation and national self-sufficiency may look upon increase either of imports or of exports as a disadvantage to the country.

The statistician as such is under no obligation to discuss these more general aspects. He has only to determine as accurately as possible the changes that have actually taken place in imports and exports of concession-articles, and so to analyze trade statistics as to throw as much light as possible on the causes of these changes, disentangling the influence of the trade agreement from the other causal factors at work. Some of the specific difficulties and problems which here confront him may now be taken up.

At the outset arises the question whether one should compare the imports, from all countries, of the articles on which the United States has made concessions with the exports, to the particular foreign country party to the agreement only, of the articles on which the foreign country has made concessions; or whether the import figures compared should relate only to imports from the other contracting party.

Perhaps the most vigorous attack of the opponents of the trade agreements program has been leveled at the practice on our part of generalizing to all countries (save such as the President excepts on the ground of discrimination against us) the benefits of any concession made to a particular country in a trade agreement. It is argued that this practice necessarily means loss to the United States because as regards the imports from third countries we give something for nothing. Persons who hold this opinion would naturally insist that imports from all countries should be compared with exports to the particular country party to the agreement. The sponsors of the trade agreement program, of course, declare emphatically that this position is fallacious. They urge that we do get something in exchange for extending concessions to third countries. They point out that not merely does each of the trade agreements made under the new act provide for mutual most-favored-nation treatment, but that we already have most-favored-nation treaties with many other countries. The pledge to us of most-favored-nation treatment means that any reduction in duties which the foreign country may make in the future, whether by autonomous action or by agreement with some third country, will be extended to us. It is urged that if we did not extend to a given country the benefit of the concessions we make under the Trade Agreements Act, it would be at once in position to terminate its most-favored-nation pledge to us. As regards countries with which we have no most-favored-nation agreements, some in fact give us the benefit of any concessions they make to third countries, and with others it is hoped to make most-favored-nation arrangements in the future.

Without necessarily taking sides in this controversy, it must be self-evident that any analysis of the effects of a trade agreement should show separately the imports from the other contracting party and those from all other countries. This distinction is of much interest to those engaged in the trade agreement program themselves. Naturally, in framing a trade agreement with a given country the United States aims in general to make concessions only on articles of which that country is the largest, if not the overwhelmingly dominant supplier, being thus in position to get as much as possible directly, and not merely indirectly, in exchange for its concessions. How far, as a matter of fact, the United States, in making a given trade agreement, has achieved this object may be revealed by comparing changes in our imports of the concession-articles from the other contracting country with those in our imports of them from third countries.

In this connection mention must be made of the errors which sometimes arise with respect to the true country of origin of imports. On account of indirect trade movements, the imports accredited to a given country may often overstate or understate the true contribution of that country to the trade. Although the margin of error in this respect is less marked in import than in export statistics, it is such in the case of certain commodities and certain countries as to make caution necessary in interpreting the changes in imports from the several countries following a given trade agreement. This difficulty is likely to be enhanced by the fact that the United States Department of Commerce is just now changing its system of recording the countries from which imports are received. Hitherto they have ordinarily been credited to the country from which the goods were consigned, which may or may not be identical with the country of origin. Hereafter the effort will be made in all cases to credit them to country of origin. This change in practive is likely in some cases to complicate comparison between pre-agreement and future post-agreement imports by countries. The difficulty could be largely eliminated if the Department of Commerce should be able, for the next two or three years, to present import data on both these bases.

The balance between concessions granted and concessions received may be measured by comparing either the percentages of increase in imports and exports or the absolute amounts of increase. Different persons will differ as to which is the proper basis.

While the trade of the United States with some countries is not far from balanced, with many countries there is normally a decided excess of exports over imports, and with a considerable number a decided excess in the opposite direction. Most persons in the United States, whether in government authority or otherwise, who have given any thought to this matter, look upon these so-called favorable or unfavorable balances of trade with individual countries as more or less natural and a subject for neither satisfaction nor dissatisfaction. They stress the idea that under the normal working of geographic and economic influences trade balancing will largely be multiangular. On the other hand, many foreign countries, particularly during recent years, have laid great stress on so-called bilateral balancing of trade; they consider it a grievance if their exports to a given country are materially less than their imports from it.

A person who considers lack of bilateral balances in trade as entirely natural might readily hold that in the case of a trade agreement with a country to which we usually sell more than we buy from it, we ought to expect a percentage increase in our exports to that country more or less equal to the percentage increase in imports from it, and thus a greater absolute increase. On the other hand, a foreign negotiator representing such a country, who views a balance unfavorable to his country as an injury, if not an injustice, may scarcely be satisfied even with equality in absolute amount of increase in trade; he would wish greater absolute increase on his side which will more nearly equalize the trade in the two directions.

The statistician as such need not discuss this question, but it becomes important that he should give equal prominence to absolute increases, and to percentage increases in his statistical analysis of post-agreement trade.

It is obvious that in seeking to measure statistically the effects of a trade agreement on exports from the United States, use must be made not merely of our own figures for exports from this country to the other contracting country but also of that country's statistics of the imports into it from the United States. In the first place, the difficulty already mentioned, with respect to the margin of error as to country of origin of imports, is still more serious as regards country of destination of exports; the statistics of the foreign country may show much more truly the movements of the trade from the United States to it than do the American figures. In the second place, as more fully pointed out later on, the foreign statistics may throw light on the causes affecting the exports in question which cannot be gained from any analysis of our own export statistics. Finally, and particularly important, is the fact that the definitions of commodities in our export statistics may not conform to the definitions in the import statistics of the other contracting country. Concessions by the foreign country are, of course, expressed in terms of its own tariff (sometimes modified by the agreement itself to meet the particular situation). It may be quite impossible on the basis of our classifications to determine what changes have taken place in the movements of certain commodities on which the foreign country has actually made concessions.

There remain a group of problems which have to do with the methods of arranging and analyzing trade statistics in such a way as to permit the influence of the trade agreement to be distinguished, at least approximately, from that of other causal factors. The tendency of a reduction in duty to cause an increase in imports of a given commodity may be more than offset by some countervailing influence; conversely an actual increase in the imports may be chiefly due to some other cause than duty reduction. Three influences of domestic origin, which are at work today in the foreign trade of the United States, are particularly powerful—devaluation of the dollar, the marked increase in general industrial activity, and the effects of drought. Various new causal factors of importance are present also in many of the foreign countries with which we trade, including among others revolutions and currency revaluations. The world is far from being in a static condition or a condition of normal trend.

To give his fullest aid in throwing light on the effects of recent agreements the statistician would have to supply to the public not merely properly analyzed data of imports and exports but a mass of statistics bearing on these other causal factors—data regarding production, especially of crops, price levels, gold movements, international investments, exchange rates, and what not. To enter further into discussion of this wider field would, however, expand the limits of this paper too far. Adequate analysis of the statistics of trade itself, independently of statistics of other economic phenomena, can do a good deal toward segregating the effect of trade agreements from that of other causes. The following discussion relates to methods of ascertaining the effects of those concessions of a trade agreement which involve reduction of duties or increases in quotas. As already stated, the statistics of trade cannot by the nature of things measure the effects of bindings of the existing status.

In the first place, it is evident that hasty conclusions should not be drawn from general totals without adequate breakdown by commodities. Changes in the trade in a few articles, possibly in a single article, may dominate in bringing about the changes in totals for a large group. Especially in cases where there is reason to believe that these major articles have been strongly affected by causes other than trade agreement concessions, it is essential to consider the data for them separately. It may readily prove that, when the figures for some one or few commodities, wherein other causal factors have been more powerful than the trade agreement, are deducted from the aggregate, it will be possible to draw from the remaining total fairly definite conclusions as to the effect of the concessions.

In the second place, no sound conclusions can be drawn from statistics for commodities on which duties have been reduced or quota limits raised without comparing the changes in these with the changes in other commodities entering into the trade with the given country.[1] Nor is it sufficient merely to deal with totals for such unaffected commodities; major individual items must be separately studied. It might transpire, for example, that although the exports from the United States to the other country of articles not affected by concessions had increased as much as or more than the exports of articles affected by concessions, yet that this was attributable solely to extraordinary increases in some few of the unaffected items, the special causes of which might perhaps be ascertainable.

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[1] Dr. Fetter in his discussion of this paper rightly points out that trade between the two contracting countries in commodities not covered by duty reductions may be increased as the result of the agreement, the added buying power of country A from larger exports of articles on which country B has lowered duties being used in part for additional purchases from country B of articles on which country A has made no reduction in duty. Nevertheless if the duty reductions were really effective, the increase in trade in articles affected by them would be expected, always of course in the absence of counteracting causes, to exceed the increase in trade in other articles. As pointed out in the text, due regard must always be given to other causes affecting the trade, but comparison of data for articles and groups of articles subject to duty reductions with the data for other articles must apparently be the beginning of any study of the effect of the trade agreement. It may be added that the concessions made by the two countries to one another may also favorably affect their trade with third countries, quite apart from the result of the extension of the concessions themselves to such third countries under the most-favored-nation practice.

In the third place, as regards the effect of a given trade agreement on our exports to the other contracting country, it is essential to make comparison with our exports of the same articles to third countries. Even, however, if it were found that exports to the country granting the concession had increased no more than exports to other countries, this fact would not necessarily prove that the concessions had been ineffective. Other causes may be at work tending to increase exports to third countries more than exports to the contracting country. Statistics of exports of articles not affected by concessions may throw light on such possible causal factors.

Obviously United States statistics should not be relied on exclusively, or even chiefly, in judging the causal effect of the concessions obtained for our exports. The import statistics of the foreign party to the agreement should be studied, comparing its imports of concession commodities from the United States with its imports of them from other countries, and comparing concession with non-concession articles in its import trade.

Of course, if the foreign country follows the practice, which the United States itself follows, of extending the benefit of any concession which it makes in a trade agreement to all other countries (or to many other countries by reason of most-favored-nation agreements), a concession to the United States will not tend particularly to increase the share of the imports of the commodity in question which is supplied by the United States. Where concessions are not so extended, however, the statistics of the foreign contracting country as to the origin of its imports may throw direct light on the effects of the concession. Moreover, the concession to the United States may itself have represented the removal of a discrimination against us in the rate of duty. This was the case with great numbers of concessions in the Canadian agreement. The grant by Canada to this country of all the lowest rates payable by any non-British country (or of still lower rates than had previously applied to any such country) meant the wiping out of a multitude of differentials previously existing in favor of most other important non-British countries, and, as regards many commodities, a reduction in the differentials against us in competition with British countries themselves.[2] In cases of this sort also the foreign statistics will, of course, tend to show whether the United States has gained relatively to other supplying countries as the result of the concessions granted to it. Again where, as in the case of several of the recent trade agreements, concessions granted by the foreign country to the United States relate to quota limitations on imports, comparison of changes in its imports from the United States with changes in its imports from other countries is essential to understand the effects of the agreement on our trade, particularly if concessions of this sort had been in the nature of removing discriminations in quota allocations previously existing.

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[2] Some of the original gain to the United States in this latter respect was withdrawn by subsequent Canadian legislation reducing certain of the British preferential rates on articles the rates on which to the United States had been reduced.

A general analysis of the import statistics of the foreign party to the agreement, relating not merely to articles affected by concessions but also to other articles, and relating to imports not only from the United States but also from other countries, may readily disclose causal factors at work within the foreign country tending to increase, or to decrease, its imports in general, and thus may help disentangle the particular effect of the concessions granted to the United States in the trade agreement.

In the use of the trade statistics of foreign countries to measure the effects of our trade agreements with them, special caution must be exercised with respect to the influence of changes in exchange rates on the significance of value figures expressed in foreign currencies or converted from such currencies. I am not here referring to the tendency of variations in exchange to stimulate or to check international trade, a matter which of course needs to be considered among the causes determining actual trade changes; our own statistics both of imports and of exports are of course affected by this cause. What is here specially involved is the interpretation of foreign statistics of value of trade. The United States, for example, has made trade agreements with the Netherlands, Switzerland, France and Belgium, among other countries. All four of these countries have devalued their currencies since the agreements were made, and this action may not merely have an absolute effect on the trade with the United States in both directions, but may likewise tend to confuse the interpretation of their value figures of imports and exports.

The last point which the limits of time will permit me to mention is this: The statistician, in order to afford a proper basis for determining the effects of a trade agreement, must not be content to compare merely the figures for a given period immediately following the trade agreement with the figures for the last corresponding period preceding it. Regard must be given also to the antecedent trends, the more so because, with the rapid changes in domestic and foreign economic conditions during the years 1933–35, these trends were often conspicuous. An increase during the period following the agreement over the immediately preceding period may have different significance according as the trade had been tending upward or downward before. Obviously, in considering these longer trends all the precautions against misinterpretations which have already been mentioned must be taken.

It may seem that with so many complexities in the use of trade statistics there can be little hope of drawing from them any conclusion worth while with respect to the effect of the recent trade agreements upon the volume of our import or our export trade. This conclusion, however, is unwarranted. Although in the case of many of the trade agreements sufficient figures have not heretofore been available to justify very definite conclusions, one may reasonably expect that after more time has elapsed it will be possible from trade statistics to form at least approximately correct judgments with respect to the influence of most of these agreements. In some cases the results are likely to be so marked that even superficial analysis will disclose them fairly well. In other cases, however, fairly extended and thoroughly conscientious analysis will be essential. It is to be hoped that a number of economists and statisticians outside the Government, especially those whose connections are such that there can be no question of having an axe to grind, will give thorough study to this subject. Some government employees who undertake such analyses presumably are not free from bias and even the most objective studies by Government agencies may be suspect in some quarters.

DISCUSSION

With the larger part of Dr. Durand's paper I am in full agreement. His painstaking analysis of the complex problems involved in measuring the effects of a trade agreement should do much to reduce the output, but improve the quality of the statistics which the public are asked to accept as evidence of the success or failure of the Trade Agreements program.

My principal critical comment is that Dr. Durand has set himself a practically impossible task when he tries to measure the benefits of an agreement, without bringing into the analysis any preconceptions in regard to international trade that might seem to be tainted by free trade or protectionist views. One cannot measure the effect of a reduction of duties, either by this country or some other country, without implicitly introducing some assumptions in regard to the operations of international trade. I appreciate Dr. Durand's position as a government official. But it seems to me that in a conscientious effort not to appear in the role of a pleader for the Trade Agreements program, he has set up unduly strict standards for judging the agreements. In his desire not to bring in a bias in favor of the agreements, he has presented a technique of analysis that involves too narrow a conception—a conception generally associated with high protectionist thought—of the ramifications of international trade. Almost inevitably, on the basis of his analysis, a number of agreements will be judged failures in the eyes of the public, even though the highly mercantilist objective of the Act—the stimulation of exports as much or more than imports—is achieved.

Dr. Durand's analysis deals primarily with measuring the effects of a single trade agreement, upon the trade between the two countries concerned, in the articles covered by the agreement. I question two practices in his technique in the measurement of the effects of an agreement: (1) the limitation of the analysis of the benefits of the agreement for American exporters to articles covered by the agreement, and (2) the treatment of articles bound on the free list or at the existing rate of duty.

The Belgian agreement covered a wide variety of articles, both exports and imports, but it touched only about one-third of our exports to Belgium, and about one-fourth of our imports from Belgium. An increase of $5,000,000 in imports of Belgian articles covered by the agreement and $1,000,000 in articles not covered by the agreement will give Belgium $6,000,000 more to spend somewhere than they had before. Without introducing any extraneous influences—such as drought or industrial revival—it is not only possible, but probable that with existing demand schedules on the part of Belgian importers, more than $1,000,000 of that $6,000,000 would be used in purchasing American articles not covered by the Agreement. There is nothing unreasonable in the assumption that exports to Belgium would increase $6,000,000 as a result of our increased imports from Belgium but that $3,000,000 of this sum would be in concession articles and $3,000,000 in other articles. If I interpret Dr. Durand correctly, the statistician would be forced to conclude that the Belgian Agreement had materially stimulated our imports from Belgium, as imports of articles on which concessions were granted increased five times as much as imports of articles on which no concessions were granted, but that it had very little effect upon our exports to Belgium, as American exports on which no Belgian concessions were made increased as much as exports on which Belgium had made concessions. Any attempt to measure the results of a Trade Agreement, and the "relative importance of the concessions granted and the concessions received," by considering only the changes in trade of articles on which concessions[1] were made, is at best of doubtful value.

Another defect in the statistical measurement of the "benefits resulting from concessions" arises in the treatment of articles bound on the free list. In a great many cases, both in the United States and abroad, articles bound on the free list are ones which had been there for years and which would probably remain there, trade agreement or no trade agreement. To picture the United States as making sacrifices when it agrees to bind coffee, silk, or rubber on the free list hardly squares with the realities, even on the basis of a highly protectionist view of American foreign trade. Since the Tariff Act of 1890 the "untaxed breakfast table"—with due concessions to the beet sugar interests—and the free admission of raw materials—with due recognition of the political power of the woolgrowers—have been as much a part of the American protective system as have been the duties on textiles and steel. We know this out of the mouths of arch-protectionists themselves. Yet in a number of trade agreements the "concessions" made by the United States have consisted largely in the binding of articles on the free list, inasmuch as practically all of our imports from those countries were already on the free list—approximately 97% in the case of Guatemala, 99% in the case of Costa Rica and Honduras, 94% in the case of Colombia, 90% in the case of Brazil. If an analysis of the effects of, say, the Costa Rican agreement, is made and these duty free articles are included in the analysis, the resulting "effect" of the agreement and the estimate of the "relative importance of the concessions" will be very different than if we only include those articles on which the duty is reduced.

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[1] Contrary to what appears to be a general belief, the term "concession" does not appear in the Trade Agreements Act. But critics as well as Administration spokesmen have chosen to use it constantly in their discussions of the various agreements, despite the misleading implication that a country is doing a favor when it consents to receive goods and is receiving a favor when it is allowed to get rid of goods.

American cotton is on the free list in most countries. In the trade agreement with Belgium our cotton was not bound on the free list, but it has been in other agreements and it may well be in future agreements. Assume that in the case of a country—let us call it Europa—which purchases about as much cotton as Belgium, the binding of cotton were the principal concession made to the United States. Including the bound cotton as a concession article in the Europa agreement, the statistical analysis might show the agreement advantageous to the United States. Were cotton not bound on the free list the analysis might show the agreement disadvantageous to the United States, even though American cotton remained on Europa's free list. The statistical measurement of the effect of an agreement in terms of the value of the "concessions" is going to depend in a good many cases on the vagaries of negotiation, which result in the mentioning or ignoring in the agreement of articles which would have remained on the free list under any conditions.

A point basic to the whole question of policy under the Trade Agreements program is the wording of the Act. Dr. Durand's emphasis on the necessity of securing benefits to American exporters in clearly in accord with the intent of the Act. The Act represents a step toward a more liberal commercial policy. It recognizes that there is a relation between exports and imports, and it envisages this relation and on a world wide, and not merely on a bilateral basis. To anyone who has followed American tariff debates, this is almost an epoch making advance in American thinking. But there is no recognition in the Act of the existence of invisible items, and the plain implications of its words are that the benefits of foreign trade are found in the exports, and that the imports are simply a necessary price that America must pay for the privilege of selling goods. The only purpose for which the President may lawfully enter into agreements is "expanding foreign markets for the products of the United States." Under a strict construction of the Act, no account may be taken of any invisibles: the fact that a country or its citizens owe large sums in the United States, and that the more liberal American tariffs would facilitate payment on these debts could not be considered in making the agreement, for this would be affording "market opportunities for foreign products in the United States" for a purpose other than the expansion of American exports. No agreement could consider the existing gold situation in the United States, by creating "market opportunities" in the hope that increased commodity imports would facilitate the export of gold, or at least stop the influx of gold. We have the paradox that the more successful the program is in helping an adjustment of our trade to our international position, the greater the grounds that critics have to charge that the Act has been violated by the framing of agreements which permitted imports to enter for a purpose other than the development of exports.

I do not criticize the Administration for the wording of the original Act; public opinion, no matter how misguided, is a potent force. That explains the paradox, but it does not remove it. The Administration may leave the wording of the Act unchanged when it comes up for extension in 1937, and simply ignore any criticism that its purpose is not being strictly carried out. Or it may change the wording so that the adjustment in the international economic position of the United States may be taken into account, and thus face the criticism that the Trade Agreements Act is being amended in the interest of foreign labor and Wall Street bankers. I leave it to those who are experts in public opinion and in the strategy of Congressional legislation to tell which is the better policy of dealing with the paradox which exists.

I concur heartily with Dr. Durand's closing remarks that we will need "extended and thoroughly conscientious analysis" of the operation of the various agreements. But I would like to raise the question whether analysis, no matter how conscientious or careful, will be helpful in determining larger questions of policy unless it is backed by a pretty fundamental philosophy—theory, if you will—of international economic relations on the part of the American public.

There is a specious appeal in the idea of statistical analysis divorced from any preconceptions of theory. To approach the problem of the trade agreements without a recognition of the international economic position of the United States, without a philosophy of international trade and finance, is as futile as to approach the problem of heart disease without having any ideas in regard to the circulation of the blood. The technical statistical analysis must be implemented in public discussion by attention to the triangularity of trade, the role of current invisibles, international debtor and creditor positions, and by a willingness to face the question whether imports are a good thing in themselves or only an unfortunate price that must be paid for the privilege of exporting. Unless this is done statistical analysis of the trade agreements, no matter how technically competent, will produce nothing but sterile debate, and will muddy still further instead of clarifying the waters of American thinking on international trade and finance. To implement this analysis is the special responsibility of the academic economist, and of the banker, the business man and the journalist with economic vision.

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STATISTICAL METHODS IN BALANCE-OF-PAYMENTS ESTIMATES*

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In introducing the first official statement[1] on the balance of payments of the United States, former President Hoover, then Secretary of Commerce, explained the importance of the compilation as follows:

> A full comprehension of the invisible items and their approximate value is not only of profound importance in assessing our international balance sheet, but no sound conclusion can be made concerning the effect of foreign-trade movements upon our credit structure or upon the ability of foreign countries to purchase our commodities or to pay their debts, or upon exchange rates, or upon the movement of gold, or the ultimate trend of price levels compared with those of other nations without some comprehensive balance sheet including the invisible items.

The sudden shift of the United States from a net debtor to a net creditor position during the World War and the inevitable international economic readjustments which followed directed special attention to our statistics of international commerce, and emphasized the need for detailed examination of our so-called invisible trade including international security transactions. In 1919 the Harvard University Committee on Economic Research published the first[2] of a series of studies which prepared the way for the Commerce Department's annual compilations which have appeared without interruption since 1922.[3]

A nation's balance of international payments has been briefly defined as "an itemized account of the commercial and financial transactions conducted, within a stated period of time, by all the people of that nation with the people of all other nations." No brief definition can possibly be entirely satisfactory if it is to cover all the ramifications of international intercourse. It cannot be said that every minor element in the reported statisitics is literally either a commercial or a financial transaction. For example, such charitable contributions as are made by American agencies to recipients abroad in the form of merchandise involve transactions which are reflected in the international balance and yet require no international exchange operations. Since it is frequently impracticable to eliminate the recorded export value of such merchandise from the official foreign trade statistics for entry in the balance of payments, it becomes necessary to make allowance accordingly for the value of such contributions in the appropriate "invisible import" account which covers all remittances and contributions whether or not effected through the international transfer of funds. This distinction, however, applies merely to one of numerous details which constantly arise, and we need not pursue the point further in a discussion of the statistical aspects of balance-of-payments methodology.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 30, 1936.

[1] *The Balance of International Payments of the United States in 1922.* United States Department of Commerce, Trade Information Bulletin No. 144, September 14, 1923.

[2] Bullock, Charles J., Williams, John H., and Tucker, Rufus, "The Balance of Trade of the United States," *Review of Economic Statistics*, July, 1919, pp. 216–254.

[3] The Harvard Committee's subsequent studies covered the years, 1919, 1920, and 1921, respectively, and appeared under the following titles: Vanderlip, Frank A., and Williams, John H., "The Future of Our Foreign Trade," (*Review of Economic Statistics*, Supplement, April, 1920, pp. 1–28); Williams, John H., "The Balance of International Payments of the United States for the Year 1920," (*Review of Economic Statistics*, Supplement, June, 1921, pp. 169–212); Williams, John H., "The Balance of International Payments of the United States for the Year 1921," (*Review of Economic Statistics*, July, 1922, pp. 201–214).

The balance-of-payments statement is, strictly speaking, a "balancing" of payments statement in which total receipts or "credits" are necessarily equal to total payments or "debits." Since it contains some outward similarities to both a corporate balance sheet and a corporate income statement, the statistical data contained therein have readily lent themselves to misinterpretation and to direct use for the advocacy of opposing commercial and financial policies. Since the balance necessarily deals with the movement of cash funds or the offsetting credit equivalents, it obviously carries no record of losses on investments as, for example, the discounts at which American banks have in recent years found it necessary to liquidate German mark payments on outstanding Standstill credits. The desirability of supplementing balance-of-payments estimates with a statement showing the international investment position of the United States and, if possible, the changes in this position from one period to another, is apparent. This must not be confused, however, with the itemization of the aggregate cash claims which a country accumulates in a given period of time against the rest of the world or with the transactions through which those claims are met.

Some of the more important estimates in the international balance are the tourist items which are based on questionnaire sampling. Others represent the aggregate of data reported by individuals or institutions and comprising all the transactions which fall within the definition of a specific item. Again, in various instances data reported previously by official agencies are employed for balance-of-payments entry, although frequently important adjustments of such reported figures must be made for the purpose of final entry. Frequently certain items are the net result of all of these approaches. Owing to the heterogeneous nature of the data involved and the importance of inductive analysis, statistical procedure becomes of paramount importance in any attempt to assess the accuracy and reliability of the final statement. The various classes of international transactions differ widely in adjustability, as well as in their ultimate effects on each other. Gold movements may, for instance, result from the lack of balance between the value aggregates of the respective trade and service transactions, or they may represent the convenient medium through which frightened capital flees across international frontiers.

No official data on international commerical or financial transactions are available which do not at least theoretically require adjustment for balance-of-payments purposes. In the use, however, of such statistics as gold and silver exports and imports and United States government receipts on war-debt account only minor errors are involved. Possible discrepancies in the imports of gold and silver may arise from year-end variations between the respective dates of customs entry and actual settlement (expecially the postponed payments representing from two to ten per cent of the value of the individual shipments) and from minor errors in import entries covering ore importations. Official data on war-debt receipts during several years in the late 1920's were slightly excessive for balance-of-payments entry because of the discount at which debtor governments were able to purchase United States government bonds acceptable at par under the debt funding agreements.

The official statistics on merchandise exports and imports require numerous adjustments for balance-of-payments entry.[4] These adjustments involve deductions from, and additions to, the reported data as well as numerous changes due to terms of sale, credit losses, fluctuations of exchange rates, erroneous customs entries, undervaluations of goods subject to ad valorem duties, overvaluations of certain classes of duty-free goods for bookkeeping convenience, additions to invoice entries for duty purposes, etc. Certain of these adjustments (for example, sales of bunker fuel to foreign vessels) can be made without difficulty because of the availability of accurate data. Others are based on inductive analysis and may or may not be reasonably correct. In a large number of cases no satisfactory approach to the problem is possible without a prior exhaustive study of export and import entries on both a commodity and a country basis. This remains a fruitful field of research for the future, and it is one the importance of which has been greatly increased by developments in international exchange markets during the past five years.

The outstanding examples of balance-of payments estimates based on questionnaire sampling are those pertaining to American tourist expenditures abroad. Four separate questionnaire forms are employed to cover, respectively (1) United States citizens visiting those foreign countries in which visas are required, (2) alien residents of the United States traveling abroad, (3) United States residents visiting Canada by motor car, and (4) United States residents visiting Canada by rail or steamship. It has been impossible thus far to devise a satisfactory method of similar sampling in the case of United States residents traveling in countries entry into which requires no passport or travel visa. This class includes the major part of so-called cruise travel, exclusive of round-the-world cruises, and travel in most of the Caribbean and Central American areas. Estimated expenditures by United States residents in Mexico are based in part on statistics made available by the Mexican Government, and in part, on data compiled by United States consular officers in the border districts. Estimated expenditures by foreign travelers in the United States, exclusive of outlays here by Canadian tourists, are somewhat unsatisfactory since no practicable means has yet been devised to determine average per capita expenditures here, either for the aggregate of foreign visitors or for individual groups of travelers.

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[4] Cf. Mears, Eliot G., "The Foreign Trade Statistics of the United States," this JOURNAL, Vol. 30 (September, 1935), pp. 501–516.

Such items as governmental receipts and payments, and charitable, religious, and educational contributions, are the unadjusted aggregate of all reported sub-items comprising the total. The same applies somewhat to immigrant remittances since the percentage of the total item subject to estimate is small. All of the principal remitting institutions are now reporting every month to the Department of Commerce, but only the aggregates of these reports are made available by the latter.

Probably the most important estimates for the purpose of our discussion are those pertaining to interest and dividend items. At the present time these items are the result of detailed computations, and may be viewed as "estimates" only to the extent that the incompleteness of certain data enforces the need for a small omission estimate. The importance of these items in balance-of-payments methodology is enhanced by the fact that they are directly associated with the statistical procedure involved in the determination of the country's creditor-debtor position on both long-term account and short-term account.

American investments abroad are comprised largely of two general classes, namely, "portfolio" investments and "direct" investments. The former are principally represented by bonds and other securities publicly-offered in the American market or purchased in the international markets. "Direct" investments pertain largely to what may be briefly viewed as American corporate investment or equity participation in foreign enterprise. The line of demarcation cannot always be clearly marked, and it is not necessary for our present purpose that we attempt precise definition.

Annual interest receipts from American investments in foreign dollar bonds, which constitute the bulk of so-called portfolio investments, are based on actual computations by individual issues. Deductions covering annual redemptions and sinking fund purchases are made on the basis of returns to a special questionnaire form submitted to every banking institution acting as agent or trustee. It is thus possible to compute accurately the total interest payments made on all foreign dollar bonds originally sold in the United States and still outstanding although the various classes of partial payments, scrip payments, and blocked-currency payments have since 1931 introduced certain difficulties in determining the exact value of dollar receipts. In the attempt to arrive at a correct balance-of-payments entry representing actual receipts by residents of the United States an even greater difficulty has developed during the past five years. Since 1931 a substantial value of outstanding foreign dollar bonds has returned to foreign hands. Estimates of repatriations, and purchases by investors resident in countries other than those of the issuers, have had to be based on the estimated net inflow of cash funds for the purchase of foreign securities. The absence of fully accurate data covering the payments for bonds repurchased by foreigners, and the varying prices at which the respective securities were sold by American holders do not permit a necessarily accurate computation of the face value. Any possible error in estimating such repurchases will necessarily be reflected in the estimates of interest payments on outstanding issues which should be credited to foreign holders. Although satisfactory data covering the value of repurchases of certain individual issues have been acquired through the cooperation of the foreign borrowing entities and their fiscal agents, any data regarding aggregate repurchases will have to be viewed as subject to slight error unless based on a detailed study in which all paying agents (and, in the case of defaulted issues, foreign borrowing entities) can be induced to cooperate.

The margin of error in the computed interest receipts, after allowing for estimated interest paid on outstanding issues which have been repurchased, is certain to be relatively small as compared with the possibility of error in the estimated dollar returns on American direct investments in foreign countries. Nevertheless, the careful and painstaking studies made during the past eight years by Dr. Paul Dickens of the Finance Division of the Bureau of Foreign and Domestic Commerce have converted what was once a kind of "no man's land" in international investment statistics into a distinctly manageable problem. As a result of a comprehensive survey made by Dr. Dickens in 1930 and based on detailed data furnished by approximately 1,750 American corporations, and data recently made available through the Securities Exchange Commission, it is now possible to estimate the returns on this class of investment in some of the more important foreign areas with a reasonable degree of accuracy. Although the originally-reported book values of some of these foreign properties have undoubtedly undergone material change during the depression, and have accordingly lost their original value as a basis of estimating income, the annual estimates of income received from abroad have been based more and more on current data furnished by the corporations themselves. The estimates for 1935, for example, were based on data submitted by a number of the larger companies whose aggregate investments abroad comprised over 55 per cent of the total. In order, however, to make possible a reappraisal of the investment value of the foreign properties and assets of American companies, a new survey is being conducted at present on a somewhat more detailed scale than that of 1930.

The problem of estimating interest and dividend payments by the United States to investors residing abroad has been somewhat more complicated, and the reported data on interest and dividend payments on foreign investments in this country are more likely to be in substantial error than the estimated receipts on American investments abroad. Space does not permit a summary of the efforts made prior to 1934 to estimate the value of these investments and the annual interest and dividend payments thereon. The data at present available are based on a comprehensive study initiated in the Finance Division of the Bureau of Foreign and Domestic Commerce in 1934. Full account had to be taken of the heterogeneous nature of foreign investments here. Probably in no other country have the opportunities for small-block equity investment been so alluring to alien investors as in the United States. At the same time a considerable volume of the total is represented by direct investments, equity interest in insurance companies, and investments held in personal and corporate trust accounts, all of which may be viewed as more or less permanent investments. Any effective method of procedure in computing or estimating the total investments had to take into account the necessity of so grouping the investments that each group could be conveniently used as a basis for determining, with a fair degree of accuracy, the total income derived by foreign holders. The manner in which the various types of investment were grouped suggests in general the methods employed in collecting and compiling the data. The values reported under the respective categories fall under varying approaches. Direct investments are based on computed book values or net capital invested; bonds and preferred shares are shown at par; common stocks are reported at market value; insurance investments represent the net equity of foreign insurance companies in their American branches or affiliates; and the value of securities held in trust accounts for foreign beneficiaries was determined by capitalizing the computed returns paid to such beneficiaries. These returns were based on data submitted by trustee institutions covering the total income from such investments paid to beneficiaries abroad.

Since the primary purpose of the study was to determine interest and dividend payments, all bonds, including defaulted issues, were entered at par value. The market value of common shares was used as a basis of valuation not because it was considered entirely satisfactory, but because no other approach seemed to be practicable. For the principal purpose in view the value of the shares could be considered as of secondary importance. The data relative to the number of shares of each stock issue held abroad, either directly or through bankers' or brokers' nominees, provide for the first time a convenient basis for computing total dividend payments made to investors in foreign countries. Owing to the mixed nature of the investments administered by trustees for foreign beneficiaries, the income paid to the latter proved the only basic data that could be acquired with the result that in this case the investment figure was derivative instead of primary.

I am inclined to view the classification by general categories for purposes of comparative analysis as a matter of secondary importance in the official presentation of the various estimates. There are obviously limits to the propriety of discussing in an official document the bearing of particular groups of data upon international trade theory. In the final analysis individual types of transactions must be considered apart from the theoretically related items. For example, during the past three years considerable attention has been called to the importance of gold imports in our balance of trade. In certain quarters the argument has been advanced that the exclusion in the official balance of international payments, of gold from merchandise trade has reflected a "favorable" balance when, in fact, the balance on merchandise account (including gold) and the balance on trade and service items combined have been "unfavorable."

I shall not enter here upon a discussion of the question of whether or not the heavy net inflow of gold during recent years has been a "favorable" or "unfavorable" factor in our national economy, nor need we consider at the moment the causes and possible consequences of the heavy net inflow of short-term and long-term capital which represented in substantial volume a statistical offset to the gold movement itself. In clarifying and restricting the problem I believe it may be appropriately suggested that in a realistic approach to the balance-of-payments statement the terms "favorable balance" and "unfavorable balance" have become meaningless, and should be permanently eliminated from balance-of-payments terminology. The qualitative elements in the international balance and its wider implications cannot be averted by a mere regrouping of items. If the inclusion of gold in the merchandise account were to be determined solely by the "commodity" nature of the metal, the problem would be relatively simple. An examination of gold movements over, say, the past ten years indicates that at times the counter factor to gold exports and imports was reflected in merchandise and service transactions, while at other times, as during the past three years, it was very definitely reflected in capital movements. An item that adjusts itself so readily to changes in political and financial conditions throughout the world tends to distort the normal influences of trade reflected in the other non-capital items if the aggregate of so-called trade and service items is uniformly defined as including gold movements. The presentation of gold (and in the United States this would include silver since 1934) as a single category does not presume to deny that gold is a commodity, but it is rather a formal recognition in the statistics of international trade that gold is a special kind of commodity which may move very irregularly and in enormous volume for reasons distinctly unrelated to the normal demand for goods and services.

It may, of course, be said that if such a distinction were made in the case of gold, the same might be said about other commodities, especially under conditions prevailing in 1933 when certain commodities were apparently exported, often on consignment, as a means of converting dollar assets into balances or investments abroad for the purpose of greater security. It must be remembered, however, that no items in the international balance can be defined with absolute precision. Few items represent to the last dollar only such types of transactions as fall within the scope of clear definition. A certain but unknown fraction of so-called immigrant remittances has frequently consisted of capital transactions since they represented transfers of savings accounts. Certain of the so-called government transactions have in recent years represented, in effect, capital payments, but it is impossible to segregate them, and they thus fall statistically within a definition which literally does not apply to them.

Should the so-called service category include "dividend and interest" items? The latter do not represent directly a demand for economic goods and services, but rather fixed charges which (unless payment is deferred or defaulted) constitute a direct measure of the exchange requirements needed in the process of transfer. The answer to our question depends somewhat on the number of categories into which the international balance should be divided for convenient analysis. As already indicated, for purposes of detailed analysis most items must be considered separately. The elimination of interest and dividend items from the so-called service transactions does not confine the latter in any event strictly to items representing the demand for economic goods, as, for example, in the case of remittances and contributions. The inclusion or non-inclusion of interest and dividend items in the service category in a statistical summary of the balance is of secondary importance provided the individual items are clearly defined. In any statement in which grouping is confined to comparatively few general categories, I believe that the practice followed by the League of Nations[5] and the Department of Commerce of including interest and dividends in the service category represents an appropriate method of presentation.

By the very nature of the balance-of-payments statement it follows that a correct evaluation of all items should bring all recorded "credits" and "debits" into balance. Yet it has happened that in certain years, notably in 1934 and 1935, the total recorded payments or "debits" exceeded the recorded receipts or "credits" by comparatively large amounts. The failure to reduce such substantial unidentified items into their component parts or to determine the identity of each of these parts limits the value of the statement accordingly. It has already been pointed out that certain estimates must necessarily be arrived at by methods which permit neither satisfactory sampling nor the use of adequate collateral data. This suggests the probability that the methods of preparing the estimates may in certain cases tend to overestimate the debit items or to underestimate the credit items. If such a tendency were inherent to a marked degree in the estimate of a particular item only, it might be assumed that the residual item itself would reflect a more or less definite trend from year to year. Although the methods of determining the various items were substantially the same in 1934 as in 1933, the net result in 1934 was a debit excess of $482,000,000, whereas in 1933 the excess was the virtually negligible figure of $38,000,000. This suggests that in 1934 the marked difference between the respective aggregate credit and debit estimates resulted from conditions peculiar to the international movements of that year. For this reason the official bulletin took special cognizance of the unprecedented inflow of gold and the marked inward movement of long-term and short-term capital. In a separate section an attempt was made to explore the possibilities inherent in these movements, and to suggest roughly the transactions which constituted the discrepancy. This approach represents, in my view, the maximum extent to which the author of the annual compilation should permit himself to venture into a statistical disposition of the residual item. The necessity for making occasional guesses must not be permitted to become magnified to the point where the wish to strike a balance becomes father to the thought. The abnormality of many international movements during recent years has undoubtedly introduced many elements which cannot at once be isolated or quantitatively measured. The probability of substantial errors in the figures reported by original sources and the likelihood of pronounced year-end lags in certain types of transactions are merely a few of the possibilities which should be explored by detailed and patient study of related items covering a period of years.

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[5] The Annual Memoranda on balances of payments prepared by the League of Nations were initiated in 1924 with the publication of the *Memorandum on Balance of Payments and Foreign Trade Balances, 1910–1923.*

IMPROVED OBJECTIVE STANDARDS OF SALES PERFORMANCE*

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A PRIMARY function of good management is to evaluate the performance of different divisions of a business organization. One of the most baffling problems has been to find yardsticks or standards by which to judge sales performance. Two different salesmen may obtain quite different results, even though under the same or similar circumstances. Furthermore, a salesman's effectiveness may vary under different regional conditions. Accordingly, the problem of devising standards of performance has been approached from several viewpoints.

Students of personnel emphasize the importance of the salesman's characteristics as affecting performance. Given the proper personal traits, performance will ordinarily be as good as can be expected. Accordingly they catalogue all pertinent facts regarding each salesman and each applicant for a sales position, and evaluate the contribution of each characteristic by analyzing the ratings placed by sales supervisors upon the performance of different salesmen. In one study of 2,724 salesmen, the effects of various environmental and personal traits were studied, including father's occupation, upbringing in country or city, personal appearance, height, weight, education, age when hired, extent and characteristics of previous employment, and marital status. This was done by grouping and subgrouping the salesmen according to the characteristics, obtaining their composite ratings in each group and comparing these ratings for various groups. Table I illustrates the method.

TABLE I
RELATIONSHIP BETWEEN APPEARANCE AND PERFORMANCE OF SALESMEN

Appearance	Number of salesmen	Average rating, per cent
Excellent	297	78
Good	1,231	66
Fair	393	51
Bad	18	42

Since these characteristics are known when employment begins, the study enables better selection of salesmen. For the type of selling involved, the study indicates that prospective salesmen, raised in the city, about 21 years of age, attractive in appearance, ambitious to learn as indicated by extra-curricular studies, and rated high in the preliminary training school turn out to be the best salesmen. Neither height, weight, marital status, nor a college education seem to have any definite effect. The usual relationship between a man's age and his performance, rising to an apex between 35 and 40 years of age and declining afterwards, is quite marked. More frequently, country bred salesmen are discharged for unsatisfactory work, and city bred men for bad habits of various kinds.

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In other types of selling the effects of these characteristics may vary both in direction and importance. Furthermore, additional characteristics may deserve consideration. In commission selling, for example, whether a man is an only son, or is the eldest, middle, or youngest of the family, or has a wife that is belittling, whining, extravagant, mothering, indifferent, or helpful, may affect his sales performance.

TABLE II

PERCENTAGE OF SALESMEN'S TIME DEVOTED TO VARIOUS ACTIVITIES

	Average	Salesmen				
		I	II	III	IV	V
Travel between stores	23	26	27	25	13	23
Waiting in store	13	7	15	16	18	13
Selling and collecting	31	31	32	26	31	34
Miscellaneous	19	17	12	25	23	10
Detail work	15	19	13	8	15	22

The most serious limitation to this approach is that it assumes sales supervisors to be capable of judging performance in different regional markets. Area, population, income, wholesale and retail outlets, roads, and many other market conditions affect performance. Hence, the supposition that if a salesman's characteristics are as good as average, his performance will be satisfactory, begs the question. Different selling conditions require salesmen possessing different characteristics. The sales manager desires measures of markets by which to evaluate performance and to shift salesmen in his quest for the most productive combination of market and personnel characteristics in each area.

The engineer tends to the opposite extreme in stressing the physical differences between markets and their effect upon performance. Miles traveled, calls made, and hours worked by salesmen vary widely and produce different results. The industrial engineer's methods of measuring time and motion may be applied to these phenomena, providing a basis for physical standards of performance. Table II shows the results of a recent study.

The standard chosen may be the average of the group, the performance of the best salesman, or an ideal composed of the best elements in individual performance.

Obviously, the apportionment of time between the different activities depends upon the mileage of each route, the number of interviews to be made, and the like. Consequently, the engineer's analysis includes such ratios as are illustrated in Table III.

TABLE III
MOTION AND TIME PER INTERVIEW

	Average	Salesmen				
		I	II	III	IV	V
Miles driven	2.6	2.5	3.1	2.8	.9	2.9
Total time (minutes)	28.0	25.0	29.1	28.5	32.8	26.4
Time spent in store	12.2	9.7	13.6	11.2	16.1	12.2
Waiting	3.8	1.9	4.4	4.3	6.0	3.3
Selling	8.4	7.8	9.2	6.9	10.1	8.9

Here again, standards may be derived, such as the average, or the highest, or the ideal as judged by competent persons.

These studies are often valuable to sales managers. They reveal the small proportion of time spent in contact with sales prospects, and the large proportion devoted to physical and routine work. As illustrated in Table IV, further analysis may reveal mal-distribution of time, which is partially controllable by salesmen.

TABLE IV
MAL-DISTRIBUTION OF SALESMEN'S TIME

Waiting* (minutes)	Percentage of total time spent in	
	Interviews	Waiting
None	54	—
1–10	35	44
10–60	11	56

* Time spent waiting to talk to dealers.

This approach encounters several difficulties. In measuring physical activities, there is a real difference between plant workers and salesmen. A standard based upon the amount of work done during one minute by a skilled plant laborer under normal conditions at a normal rate of speed requires that all conditions affecting performance are the same for similar workers and the only variable is the operation being timed. Salesmen, however, do not work together under identical conditions, but travel in residential and shopping sections, foreign-born, negro, and native white communities, under conditions of greater or less competition. As Table V shows, country and city bred salesmen must have different standards. Comparability of physical performance in standard-making requires the selection of routes having similar conditions. When these are widely separated, standards are less acceptable to the salesmen involved.

The salesman who performs the most operations per hour may not be the best salesman. If he spends a longer time arranging retail displays for larger dealers in order to improve sales, he should not be judged inefficient and penalized because the number of calls made per hour, miles traveled per hour, and similar measures of his physical efficiency have declined. The mechanical viewpoint must be extended to consideration of the end product and the conditions affecting it. Realizing this difficulty, the engineer may calculate the sales volume per hour or per interview and endeavor to make systematic allowances for physical influences upon these ratios.

TABLE V

SALESMEN'S UTILIZATION OF TIME

	City	Country
Miles per call	0.7	2.7
Minutes per mile	4.4	3.0
Travel, minutes per call	3.6	7.2
Interview, minutes per call	9.4	11.2
Miscellaneous, minutes per call	5.2	8.2
Total minutes per call	18.2	26.6

Certain important discoveries may be made. Beyond a certain stage, the adding of salesmen in order to reduce travel time yields smaller additional sales with each added minute of selling time. The same tendency is found when the proportion of salesmen's time given to selling a particular product is allowed to vary.

Second, equal time devoted to different products yields different amounts of sales. Salesmen not only attempt to sell some products more often than others, but the proportion of successful attempts varies greatly. Furthermore, as indicated in Table VI, there is a direct relationship between frequency of attempts and successful attempts, indicating that salesmen follow the line of least resistance.

Since the time spent per attempt to sell each product is often about the same, the wide variation in the physical effort necessary to sell equal units of different products is apparent. Diminishing returns take place more rapidly in selling some products.

Third, the relative importance of large and small stores on a salesman's route affects the volume per minute of selling effort. Calling on additional stores of smaller size will reduce the volume per minute of interview time and increase the volume per minute of traveling time at a different rate. The engineer would extend coverage to a point of maximum effectiveness, beyond which volume per minute tends to decrease. Obviously this most favorable point of coverage varies regionally and depends upon many factors, both physical and economic in nature. Moreover, extension beyond this point might be profitable.

Fourth, the differences between areas, other than customer size and type, affect both the time spent in coverage and the volume sold. All conditions which go to make up markets from an economic standpoint must be considered.

TABLE VI

VARIATION IN ATTEMPTS TO SELL DIFFERENT PRODUCTS AND ITS RELATIONSHIP TO SUCCESSFUL ATTEMPTS

Different products	Ratio of sales attempts to total interviews	Ratio of successful attempts to total attempts
A	75	51
B	49	46
C	34	31
D	31	39
E	19	31
F	10	16

Fifth, the engineer has been troubled by the variations from time to time in the sales volume per unit of effort. Here again, the limited approach does not allow for changes in business conditions, supply and demand, competition, and the like.

The economist has stressed the differences in regional consumption.[1] The characteristic method has been to estimate the total consumptive possibilities of each area and to compare the portions of total consumption sold by a company's salesmen. However, lack of consumptive data has often made necessary the use of less dependable measures of the market. For example, variations in native white or total population were regarded as indicating general variation in the regional consumption of many staple foods.

An early practice was to compare the regional percentages of the population with corresponding percentages of the national sales of the product. The difficulties involved led to the practice of comparing the per capita sales of different areas, using either the average performance or the best performance as a standard. Now, many executives clearly recognize that variations in per capita sales are not solely due to differences in selling ability. The influences of numerous other regional characteristics are being measured by simple and multiple correlation and combined into estimates of consumption or of sales with which actual performance may be compared. Table VII provides a simple illustration.

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[1] For a detailed discussion of the economist's viewpoint on this subject, see the following papers by the author in the *Journal of Business* of the University of Chicago: "Sales Quota Determination," Vol. VIII (1935), pp. 225–256; "Regional Consumption and Sales Analysis," Vol. VIII (1935), pp. 345–381; and "Sales Analysis from the Management Standpoint," Vol. IX (1936), pp. 52–76, 170–188, 231–257, 368–388 and Vol. X (1937), pp. 14–29.

TABLE VII

PERFORMANCE IN SELLING A PRODUCT IN SIX AREAS

(Standards based on analysis of 48 areas)

Area number	Sales per 1000 people	Estimated sales (standard)	Percentage actual sales of estimated sales	Performance ranking
1	37	20	185	5
7	23	10	230	1
11	21	26	81	37
18	15	14	107	21
31	10	16	62	42
38	6	5	120	17
46	3	7	43	48

While these methods of deriving standards of performance from performance itself represent a very important forward step, important aspects of the problem remain to be considered. First, regional variations in sales may or may not parallel those in total consumption because the characteristics of the individual product may differ from others of the same class. A high quality, high-priced product may sell in greater volume in high income areas than lower quality products. Consequently, the distributor should analyze his own sales in order to learn more exactly how varying regional characteristics affect the sales of his own product. On the other hand, this analysis does not show him clearly what those relationships might be and what proportion of total consumption he might obtain were he to change the character of his product. Thus, a knowledge of total consumption remains of some importance in appraising sales performance.

As a second complication, regional sales of a particular product are affected by four kinds of factors: consumptive, merchandising and competitive, pricing, and effort. The decisions of management affect the last three to a varying degree. After measuring the influence upon sales of all types of factors, two standards of performance may be derived; one based on the separate effects of the consumptive factors only, and the other on the combined effect of all the factors. Standards based only on the former indicate what regional consumptive possibilities would be if customers could be persuaded not to buy competitive products. They help in the more effective distribution of various forms of effort and enable the appraisal of all the elements in sales performance, including management's direction of effort.

On the other hand, all types of measurable influences should compose the standard if the purpose is to compare the performance of regional sales organizations, assuming the present regional selling and advertising effort is fixed in quantity. This sales index makes possible the closer approximation of the ability of the sales force in each territory under existing measurable conditions relating to consumption, merchandising, pricing, and quantitative expenditure of effort.

The third difficulty is that existing regional relationships may not hold to the same degree in later years and, as a consequence, standards derived from one year's sales may not be dependable in judging another year's performance. Changes may take place in a product's price or consumer purchasing power, and different classes of consumers varying in regional importance may enter the market for some products or shift their consumption to different products. Consequently, repeated yearly analyses of sales are desirable from time to time in order to provide the information necessary for periodic adjustment of standards.

Fourth, the analysis of volume, important and beneficial though it is in sales management, is not sufficient in setting ultimate standards of performance. The selling prices of some products are not fixed and are not regionally uniform, even though tending to uniformity after allowing for transportation costs. The ability of salesmen to charge what the traffic will bear might be judged by comparison with average gross margins of numerous areas were it not for the influence upon regional margins exerted by other factors such as competition, purchasing power, consumer insistence upon obtaining certain products as a result of advertising, regional relationships between consumption and prices, the importance of different types and sizes of buyers, and the varying proportions of products sold at different margins.

The salesman, however, is an economic unit, and sales performance consists not only of selling quantities of goods at different prices and margins but of earning profits in so doing. Ultimate standards of performance should, therefore, include consideration of effort and of expenditures in relation to income. The engineer's measurements of the physical activities in selling must be converted to an economic basis. For instance, the tendency for each succeeding minute of selling time to yield smaller additional volumes must be converted to a comparison of the income obtained with expense incurred in order to learn how far it is economical to extend the expenditure of time and effort. Salaries and other expenses vary regionally. Varying amounts of effort and expense are necessary in selling different products. Small and large buyers and various types of outlets require varying direct selling expenditures, in some instances exceeding the gross income obtained. The point of greatest net profit on a salesman's route is not alone determined by tendencies in travel time and other physical activities or by tendencies in volume, margins, and expenditures taken by themselves, but by the optimum combination of them under the economic conditions of each area. Naturally there is wide variation in the ability of salesmen as well as of management to accomplish this end under the varying conditions of place and time.

The ultimate to be sought must, therefore, be standards of performance in earning profits. While these standards may seem impossible to devise at present, continuous analysis of sales phenomena in order to uncover many fundamental tendencies and to see their importance will continue to carry us nearer the goal. In the meantime, the use of standards of volume, of physical effort, and of money expenditures, of gross profits, and even of the characteristics of sales personnel may serve as stepping stones to the ultimate goal. They must be used cautiously and with the full knowledge that, when coupled with incentives for their attainment, too much stress on volume, on physical effort, or on some other element of sales performance may injuriously affect other phases of that performance and so reduce final profits below what they ideally should be.

STATISTICAL COST CURVES*

By Joel Dean
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The principal objectives of this investigation were, first, to develop practical methods for determining the behavior patterns of a firm's average and marginal cost, and second, to explore, by means of these methods the cost behavior of two sample enterprises, one representing short-run adjustments, the other, long-run cost behavior.

At the outset, the meaning of certain concepts used in this discussion should be made clear. By average cost is meant the total cost divided by the number of units of output; and by marginal cost, is meant the addition to total cost caused by the production of an additional unit or output. The short-run is defined as a period so short that the scale of plant remains fixed, and cost adjustments are therefore made by varying the intensity of use of fixed factors. The long-run refers to an adjustment time sufficiently long to permit changes in the scale of plant, assuming short-run adjustments to be optimum for each scale.

SHORT-RUN AVERAGE COST BEHAVIOR

A brief chronicle of the difficulties encountered in the investigation of short-period cost patterns will provide concrete illustrations of the most important of the methodological problems faced in determining statistical cost curves. The first task was to obtain data which would reflect short-run cost adjustments uncontaminated by long-run changes. A furniture factory was chosen whose cost records were available in considerable detail for two-week accounting periods, covering a three-year span (1932–34) during which pronounced short-run variation in operating conditions was unaccompanied by change in the scale of fixed plant.

Since this factory manufactured a great variety of models and styles of furniture a second major problem arose in devising a common denominator for measuring this diverse output. Faced thus with complex theoretical problems of joint production, the best practical solution appeared to be to cut this Gordian Knot by using as the output unit the sum of the deflated standard costs of the articles produced.[1] Since this output index (called hereafter "old warehouse value") is a weighted summation of standard inputs, it does not reflect changes in input caused by altered operating conditions; and since it is deflated to a base period, it does not reflect fluctuations in market price.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, December 30, 1936.

[1] This standard cost was estimated in the usual fashion, on the basis of a standard quality of material, standard labor and machine efficiency and a normal rate output; it was deflated to the price and wage levels prevailing in the base period.

A third major problem was to reduce the cost observations to usable form. In the first place, since wage rates and material prices fluctuated greatly during this tempestuous period, the time series of dollar costs had to be corrected for rate changes. This adjustment was accomplished by means of index numbers specially constructed for each item of cost from price data found in the purchase records of this firm. In the second place, since the firm employed a process cost system rather

PARTIAL REGRESSION CURVES FOR CORRECTED AVERAGE COMBINED COST WITH SIX INDEPENDENT FACTORS: OUTPUT (X_2), SIZE OF PRODUCTION ORDER (X_3), NUMBER OF NEW STYLES (X_4), INCREASE IN PRODUCTION (X_5), LABOR TURNOVER (X_7), AND QUALITY OF MATERIAL (X_8).

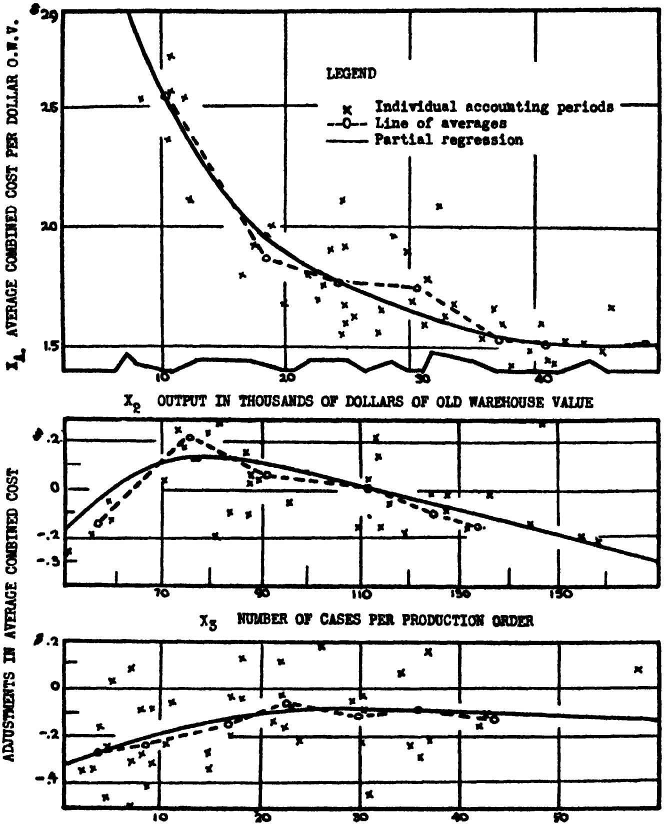

FIG. 1a

than a specific order system, the data had to be adjusted for discrepancies occurring between the time at which costs were recorded, and the time at which output was reported. Lag corrections were computed for each type of cost and for each pertinent operating condition.

When recorded cost had thus been deflated and matched with recorded output, graphic multiple correlation analyses were made of combined cost and of several of its components. The following operating conditions were chosen as independent variables: output, size of production order, number of new styles, changes in output from that of the previous period, rate of labor turnover, and quality of materials.

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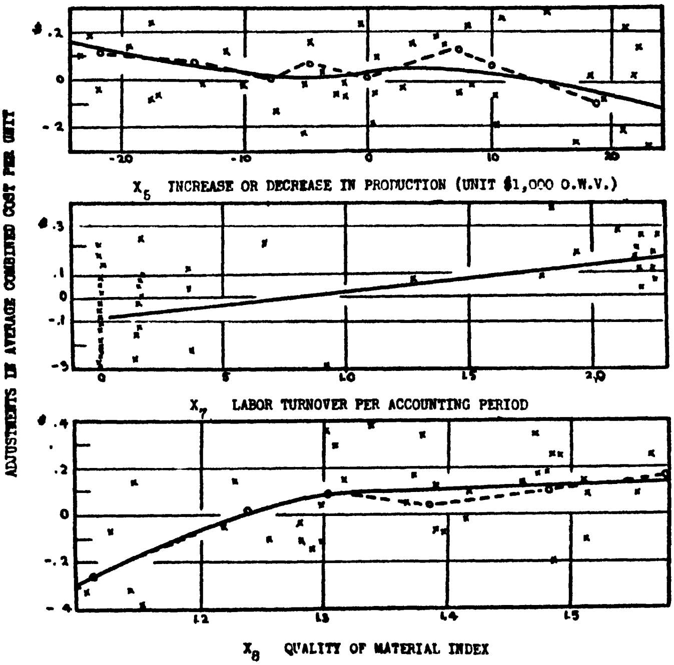

FIG. 1b

The net regression curves obtained for corrected average combined cost (Fig. 1a) are, for the most part, in accord with reasonable expectations for short-period cost behavior. Average cost continues to decline, however, throughout the observed range of output. This behavior suggests the possibility that under conditions of monopolistic competition, with rapidly rising selling costs a firm may not normally push production to a point beyond which manufacturing costs actually rise. These data appeared to cover the entire range of variation in actual operating conditions for this plant during the past 10 years.

The important relationship of cost to the other independent variables calls attention to the inadequacy of the simplified neoclassical concept of cost as a function of output alone (Fig. 1b). Broadening the analysis to measure quantitatively the effect of other operating conditions has the additional managerial advantage of providing the informational foundation for the construction of flexible expense budgets and adjustable cost standards which considerably increase the accuracy of cost forecasts and make cost control more just and more effective.

In addition to allowing for the effect upon cost of various operating conditions these quantitative statements of relationship may aid in the control of the conditions themselves. For example, this study provides a measure of the average cost of labor turnover which, when converted into marginal form, constitutes the rational basis for deciding upon the profitability of personnel policies which will reduce turnover. Similarly, decisions regarding the proper size of manufacturing lot can be made rationally only by comparing the marginal cost of increasing the size of production order with the marginal cost of storing the resulting increment in inventory.[2]

Regression curves of the components of combined cost were also determined. These curves not only furnish detailed information needed for cost control, but also throw additional light on the character of cost behavior. It is interesting to note that so-called direct cost items were not proportionately variable with output, as is frequently claimed and that no overhead item analysed was completely invariable. Apparently most of the items of this firm's cost classification fell somewhere between the Economist's variable cost and his fixed cost.

MARGINAL COST BEHAVIOR

In using this quantitative knowledge of cost relationships for estimating marginal cost three major problems presented themselves. First, the eminently practical question, "Is full rectification of the data, by means of price correction, lag adjustment, and multiple correlation, necessary in order to obtain reliable estimates of marginal cost?" Second, "Can better marginal cost results be obtained when cost data is kept in terms of total cost per accounting period, than when it is manipulated in terms of averages per unit of output?" Third, "What methods of curve fitting and differentiation give the most satisfactory estimates of marginal cost?" To answer these questions experiments with alternative procedures were carried out in each of these three directions.[3]

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[2] Statistical measures of this type are superior to any accounting estimates, first, because they reflect the direct as well as the indirect effects of these operating conditions, and second, because they provide estimates of incremental cost and of relative importance not obtainable by accounting procedures.

After comparing the marginal cost estimates obtained by identical methods from total cost data representing four stages in the correction process it was regretfully concluded that in this particular case (which may not be typical), nothing short of complete correction of the data yielded satisfactory estimates of marginal cost.

Extensive experimentation with cost data in the form of averages and in the form of totals, in an effort to answer the second question, led to the general conclusion that more reasonable and reliable marginal cost estimates were obtained from data in the form of totals. Marginal cost curves which were derived from average cost data were found to have large, spurious fluctuations attributable to slight alterations in the curvature of the average cost function. Since marginal cost has a simple rather than a complex functional relationship to total cost, these unwarranted fluctuations in marginal cost could be prevented when functions were fitted to total cost observations.

To answer the third question, a comparison was made of the marginal cost estimates obtained from identical data by alternative methods of curve fitting and differentiation. Graphic, selected points, and least squares methods of curve fitting were tried out, and differentiation of the resulting functions was accomplished by taking tabular first differences and by means of differential calculus. It was concluded that for commercial purposes simple informal methods were to be preferred to more rigorous procedures. Freehand curve fitting gave results sufficiently accurate for the crude data used, and had the important advantages for commercial work of simplicity and economy.

Using the preferred method developed by this experimentation, marginal cost functions were obtained both for combined manufacturing cost and for several of its more important components.[4] It has already been noted that marginal combined cost appeared to be constant over the range of output included in this study. Short-run marginal cost curves have commonly been supposed to rise as output is increased, because of the operation of the law of diminishing returns. The unexpected observed behavior found in this study may merely be the result of an incomplete or non-typical sample; it may, however, indicate that price theory has failed to consider important organizational and psychological factors which work counter to diminishing returns or that quasi-monopolistic conditions of supply of certain input factors have offset the workings of this tendency. The data are probably too crude and limited to warrant generalization concerning the character of the marginal cost function. These results are not advanced as typical or even as statistically significant, but only as suggestive of a procedure useful for further exploration.

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[3] For more complete analysis of this problem see the author's monograph, *Statistical Determination of Cost with Special Reference to Marginal Cost*, Chicago, University of Chicago Press, 1936.

[4] Results of the analysis of components of marginal combined cost are summarized in Appendix B of the author's monograph previously cited.

Up to this point in the analysis of marginal cost we have devoted attention exclusively to the output margin of cost. But from the multiple correlation analyses of average and total cost we know that cost is really a function of many operating conditions, the rate of output being only one of them. Since this is the case, cost has other margins besides the output margin. For example, increasing the number of new styles has an incremental cost which is analogous to that resulting from increase in output. Neo-classical price theory abstracts from these other margins of cost. This approach is too simple for many practical pricing decisions, since the acceptance of a particular order frequently causes simultaneous change in several operating conditions. A summation of these cost increments is therefore required in order to determine the true additional cost of the order. These other cost margins, as was noted earlier, are also needed as the informational basis for rational decisions regarding the control of the operating conditions themselves.

LONG-RUN COST BEHAVIOR

As a supplement to this short-run cost study an investigation was made of average and marginal cost behavior in the long run. Data for this study were obtained from a personal finance corporation which operated about 150 branch offices, each of which was treated, for the purpose of this investigation, as an individual establishment. Limited space forbids discussion of techniques and findings. Regression curves were obtained by graphic multiple correlation analyses of combined operating cost per account using the following independent variables: size of office, measured by the number of open accounts; percentage of accounts delinquent; and population of branch office city.

The cost behavior revealed by these curves was in accord with reasonable expectations. Cost per account was higher for small offices and for offices having a large proportion of delinquent accounts; and cost increased as a logarithmic function of the size of the branch office city. These regression curves provided a highly useful and easily administered flexible standard of branch office expenses.[5] The most reliable estimate of long-period marginal cost which can be made from these data is that it is constant, regardless of the scale of operation.

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[5] A parallel analysis of several components of combined cost further facilitated cost control and indicated that behavior patterns of components were of the same general character as those of combined cost.

PRACTICAL USEFULNESS OF THIS STUDY

Neither these results, nor those of the furniture study can be regarded as typical or conclusive. Subsequent investigations, with better data and more sophisticated procedures will doubtless produce more reliable and significant findings.

The chief function of this study is to point out the obstacles to be overcome, to suggest a practical way of surmounting them, and to indicate the relevance for cost control and for price policy of the type of information provided by this study. As such, it is hoped that this investigation will be useful to economists and to business men.

Economists will find this study stimulating first, because it presents an empirical determination of cost curves which play a crucial role in modern price theory, second, because it develops a method for providing the entrepreneur with information economists have erroneously assumed he possessed (namely, knowledge of his average and marginal cost functions), and, third, because it indicates the questionable realism of certain phases of neoclassical cost theory.

Business men will find the results of this type of study valuable because these findings constitute a new type of managerial information which is highly useful, first, for constructing accurately a comprehensive flexible budget, second, for establishing adjusted standard costs, and third, for estimating marginal cost.

Budgets are most effective when they can be modified flexibly to correspond to reasonable cost expectations resulting from the particular set of operating conditions prevailing in the budget period. Quantitative knowledge of the probable effect upon cost of these conditions makes such budget modifications more accurate and thus renders the budget more useful for prediction and for control. Similarly, cost standards which can be adjusted, on the basis of known cost relationships, so as to allow for operating conditions over which the factory management has no control and for which it should therefore not be held responsible, are fairer and more effective as control devices. Finally, estimates of marginal cost obtained from statistical studies of this type are of great importance in the rational formulation of business policies, since a large proportion of executive decisions should properly be made by comparing the marginal costs of alternative methods or by balancing the marginal cost caused by a contemplated policy against the resulting additional revenue.

METHODS USED IN STRIKE STATISTICS*

By Florence Peterson
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In all the realm of industrial statistics, employer-employee disputes present some of the most baffling problems. In addition to the factor of judgment which enters into all statistical procedure, strikes and lockouts, by their very nature, lead to differences of viewpoint and approach in their measurement and classification. Since they are controversies in which the interests of employer, workers and the public are at stake, each of these groups naturally interprets and evaluates the situation in the way the dispute affects it. This divergency of viewpoint persists throughout every phase of the statistical treatment of strikes and lockouts;—their definition, unit of measurement, magnitude, causes and results. Furthermore, strikes and lockouts very often are indeterminate from whatever approach they are viewed. Causes leading up to any one dispute may be many and varied and the basic causes may never be actually voiced by either party. So also with the results, especially when the dispute ends with no written contract or definite oral agreement. Even the date of the ending is not always clear-cut; some strikes begun years ago have never been officially called off by their initiators, yet the concern is carrying on its business.

In view of these divergencies of approach, indefiniteness, as well as the impossibility of always getting sufficiently detailed information, much of the statistics on strikes and lockouts is necessarily based on arbitrary estimates and rule-of-thumb procedure. Nevertheless, through the use of specific definitions and the adoption of some broad general policies, a certain degree of comparability and uniformity of treatment can be obtained. The following summarizes the definitions and methodology which the Bureau of Labor Statistics is applying to its statistics on strikes and lockouts in the United States.

PURPOSE

Statistical technique must be adapted to the problem at hand. A strike or lockout is an evidence of discontent and an expression of protest. While some strikes may arise over minor internal shop matters, by and large strikes cannot be dissociated from the general economic and political situation existing at the time, or the general condition within the particular industry. The trend of prices and cost of living, the amount of unemployment, the prosperity of the particular industry, the political situation as expressed by statutes, police and court action, the state of mind of the public, the degree of organization among the workers,—all of these have their direct and indirect bearing on the frequency and character of employer-employee disputes. The purpose of strike statistics would seem to be, therefore, to keep a count of the number of disputes and their magnitude,—a temperature recording, as it were, of the degree of industrial unrest. Since strikes are evidence of pathological conditions in our economic process, strike statistics should record and classify the causes, results, characteristics of the participating parties, and any other information which would contribute toward a better understanding of the group interests involved and the methods they use to advance these interests.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 30, 1936.

Definition of Strike and Lockout.—A strike is a temporary stoppage of work by a group of employees in order to express a grievance or to enforce a demand. A lockout is a temporary withholding of work from a group of employees by an employer (or a group of employers) in order to coerce them to accept the employer's terms.

Each word in these definitions has a particular significance:

A strike is a *temporary* stoppage: So far as the intention and attitude of the strikers is concerned, they continue to retain the status of employees of the company against which they are striking, with vested interests in their individual jobs. If the dispute develops into a permanent severance of relations between the employer and this group of workers, the situation ceases to be a strike.

A *stoppage* of work is effected either by walking out, not reporting for work at the usual or expected time, or reporting for duty but refusing to perform any work ("sit-down" strike). A walkout is a fairly clear-cut situation, but the other two forms of stoppage are sometimes difficult to interpret. For instance, workers in seasonal or intermittent trades (fruit pickers, longshoremen, building workers, etc.) refuse to go to work on terms offered by an employer. There is no actual walkout, since work has never started on the season's fruit picking, loading or unloading the boat, or constructing the building. To the employer who needs to have the work done, refusal to work means a serious stoppage. Such situations are considered to be strikes, since the Bureau interprets a strike to exist when an employer offers jobs to a specific group of workers who refuse to accept until certain terms or conditions are adjusted. Restriction of output, or sabotage, sometimes approximates a "sit-down" strike. The Bureau interprets the situation as a strike only when the participants publicly state the fact of a stoppage for certain specific causes.

A strike or lockout implies stoppage of work by a *group.* An individual stoppage is a "quit" or "layoff." For purposes of convenience, the Bureau includes in its statistical analysis only those disputes which involve six or more persons and last one day or longer.

The strike must be by a group of *employees;* that is, there must be a recognized employer-employee relationship between the parties involved in the dispute. Statistics on labor disputes, therefore, exclude so-called buyers' strikes, farmers' strikes, such as milk strikes (except in the case of farm labor), student strikes, etc. There are certain borderline situations in which it is difficult to determine whether the strikers have the status of employee or entrepreneur, as, for example, the small dealer who is producing or distributing goods or services for another person or company. The Bureau considers an employer-employee relationship to exist when one of the parties maintains direction and control over the work of the other; that is, the right to approve or disapprove employment, and control over working conditions. Thus the term "employee" covers gasoline station attendants, even though on a lease and contract sales arrangement, fishermen who must sell their catch to one certain wholesaler who determines the price, and persons who manufacture at home for contractors.

The purpose of a strike or lockout is *to express a grievance* or *to enforce a demand.* It is a fairly simple matter to interpret a stoppage of work as a strike or lockout when either the worker group or the employer makes definite demands upon the other. Some situations, however, are not so easy to define, such as jurisdictional disputes, quarrels between rival unions, sympathetic protests, organization drives by outside unions where employees within the plant seemingly take no active part. In the usual jurisdictional dispute it would appear that the employer is passive,—that it is a quarrel solely between worker groups who have no grievance against their employer. (In some cases the employer very obviously has an interest in which union does a particular piece of work because of differences in wage rates.) Fundamentally, however, each group is demanding from the employer that it get the assignment for certain work, and thus jurisdictional disputes can justifiably be called strikes.

Disputes between rival unions present a somewhat different picture. In these cases a second group with identical trade jurisdiction seeks to displace a union which has already been recognized by the employer. (Since the American Federation of Labor does not permit dual unionism within its ranks, at least one of the two groups fighting for control is a union not affiliated with the A. F. of L. Sometimes neither organization is affiliated.) While the immediate issue causing the stoppage of work appears to be the rivalry of two factions of workers, the employer is, nevertheless, an integral factor in the situation,—the very fact that there are two rival unions fighting for control generally signifies discontent by one group of workers with the terms which the other union has obtained from the employer and the hope that the second union can obtain better terms.

The employer-employee relationship need not necessarily be direct and proximate to permit a strike situation. In a so-called sympathetic strike, an individual employer may not be responsible for any of the dissatisfactions which bring about the strike. These are, nevertheless, strikes since they are called for the purpose of demonstrating the solidarity of workers and broadening the group pressure upon the employer(s) against whom there is a strike for specific cause.

STRIKE OR LOCKOUT

Previous to 1922, the Bureau presented separate tables for strikes and for lockouts. Because of the inherent confusion existing in any industrial dispute, the difficulty of separating a strike situation from a lockout was early recognized. In more recent years no effort has been made to distinguish the two, and all labor disputes involving stoppages of work were grouped together as "Strikes and Lockouts." This awkward phrase was abandoned in 1935, the term "strike" being used in the generic sense to include all stoppages of work due to labor disputes, whether initiated by employer (lockout) or by the workers.

UNIT OF MEASUREMENT

One of the most difficult phases of strike statistics is that of determining the basic unit to be counted and classified. Obviously, a trend of the number of strikes is meaningless unless the unit counted possesses certain uniform characteristics. An individual dispute may be viewed from the standpoint of the extablishment or establishments involved, the group of workers affected, or the community or communities in which it takes place. In statistical treatment, difficulties arise from whichever angle the matter is viewed.

Shall a general strike called by an international union, extending into several states and hundreds of establishments, be called one strike or as many as there are employers, states or cities affected? Shall strikes in several branches of one corporation, located thousands of miles apart, be considered one strike or as many as the number of communities affected or the number of local unions which agreed to the stoppage? A local union calls a strike against dozens of employers engaged in the same business in the same city. Perhaps it is the union's strategy to call out one shop at a time instead of simultaneously. Some of the employers settle with the union and work is resumed while other shops are still closed or perhaps have not yet been called out. Is this continuous campaign on the part of the local union to be classified as one strike or many? Several craft unions call a strike against the same employer. Is this one strike or shall the number of unions involved be the determining factor? A local union is carrying on a strike in a certain plant. Six other local unions in the same city decide to stop work in sympathy. Is this one general strike, two strikes, or seven strikes?

Any method used to determine the unit for statistical measurement of strikes must be elastic enough to fit the varieties of situations which arise. At the same time, any method is necessarily arbitrary when applied to any individual case. As a working hypothesis, the initiating force and cause of the strike is the determining factor now used by the Bureau in deciding what shall be the unit of measurement. In other words, how the strike was started and for what reason, takes precedence over the number of establishments or localities affected.

ITEMS INCLUDED IN THE STATISTICAL ANALYSIS

Thirteen basic items are now used by the Bureau of Labor Statistics in its statistical analysis of strikes, namely:

Industry
Geographical location
Number of establishments
Number of workers
Sex of workers
Beginning date
Ending date
Duration
Man-days idle
Labor organization involved
Causes
Results
Method of settlement

Much could be said in explanation of the meaning and coverage of each of these items, variations of which lead to wide differences in statistical presentation. To anyone who is familiar with the typical strike situation, the complexities and difficulties in classifying strikes by their causes or demands and by their results are at once apparent: So few strikes are due to one or two clear-cut causes; fewer result in clearly defined terms which can be accurately classified. Even such an apparently simple item as "number of workers involved" is variously understood and used. Some statistical treatments include two classifications, viz., "directly" and "indirectly." The "directly involved" are supposed to include those employees who initiated or voted to strike;

the "indirectly involved" the remaining employees, or workers in other plants, who were forced to stop work when this shop closed because of the strike. Under these various concepts, the number involved could be given as 50, 5,000 or 50,000. Currently, the Bureau arbitrarily confines the number to include all employees within the establishment who stop work or are thrown out of work, thus making no attempt to separate the "directly" or "indirectly" involved.

HISTORY OF STRIKE STATISTICS IN THE UNITED STATES

The first count of strikes in this country was made at the time of the Tenth Census, in 1880. Four periodic surveys were made by the Commissioner of Labor between 1881 and 1905, these providing a continuous series for this period. No data were gathered between 1906 and 1913. During 1914–26, the Bureau of Labor Statistics maintained a fairly adequate reporting service on the number of strikes and lockouts but in only a limited number of cases were data obtained on the number of persons involved, causes, results, and other items.

Since 1927 the Bureau has collected and published more or less complete data on most of the items described above. Two years ago the statistical work was somewhat reorganized: The number of possible sources for first learning about the occurrence of strikes was materially increased—thus insuring an approximately complete coverage. The former occupational classification was changed to industry classification to conform to that used in the Census and the Employment and Pay-Roll statistics of the Bureau of Labor Statistics, and the definitions and inclusiveness of certain items were altered. In order to provide continuous series in as many classifications as possible, available data for all strikes which have occurred since 1927 have been reviewed and revised. Incomplete information on hand made revision previous to 1927 impossible. These revised tables, together with a complete summary of all the statistics on strikes in the United States which have ever been published, will be included in a forthcoming bulletin of the Bureau of Labor Statistics.

NUMBER OF STRIKES

As explained above, due to incomplete data and differences in interpretation, the figures on number of strikes occurring throughout the years are not entirely comparable. Considering the indefiniteness and proximate nature of any strike statistics, however, it would not appear unreasonable to link the various series for rough comparison, even though they were obtained by somewhat different methods:

NUMBER OF STRIKES AND WORKERS INVOLVED, 1881-1935
(1906-13 Omitted)*

Year	Number of		Index		Year	Number of		Index	
	Strikes	Workers Involved	1927-29 = 100			Strikes	Workers Involved	1927-29 = 100	
			Strikes	Workers				Strikes	Workers
1881	477	130,176	64	42	1906	*	*	*	*
1882	476	158,802	64	51	to	*	*	*	*
1883	506	170,275	68	55	1913	*	*	*	*
1884	485	165,175	65	53	1914	1,204	*	162	*
1885	695	258,129	93	83	1915	1,593	*	214	*
1886	1,572	610,024	211	196	1916†	3,789	1,599,917	509	514
1887	1,503	439,306	202	141	1917	4,450	1,227,254	598	495
1888	946	162,880	127	52	1918	3,353	1,239,989	451	399
1889	1,111	260,290	149	84	1919	3,630	4,160,348	488	1,337
1890	1,897	373,499	255	120	1920	3,411	1,463,054	458	470
1891	1,786	329,953	240	106	1921	2,385	1,099,247	321	353
1892	1,359	238,685	183	77	1922	1,112	1,612,562	149	517
1893	1,375	287,756	185	93	1923	1,553	756,584	209	243
1894	1,404	690,044	189	222	1924	1,249	654,641	168	210
1895	1,255	407,188	169	131	1925	1,301	428,416	175	138
1896	1,066	248,838	143	80	1926	1,035	329,592	139	106
1897	1,110	416,154	149	134	1927	707	329,939	95	106
1898	1,098	263,219	148	85	1928	604	314,210	81	101
1899	1,838	431,889	247	139	1929	921	288,572	124	93
1900	1,839	567,719	247	182	1930	637	182,975	86	59
1901	3,012	563,843	405	181	1931	810	341,817	109	110
1902	3,240	691,507	435	222	1932	841	324,210	113	104
1903	3,648	787,834	490	253	1933	1,695	1,168,272	228	376
1904	2,419	573,815	325	184	1934	1,856	1,466,695	250	472
1905	2,186	302,434	294	97	1935	2,014	1,117,213	271	359

* No information available.

† The number of workers involved in strikes between 1916-26 is known for only a portion of the total. However, the missing information is for the smaller disputes and it is believed that the total here given is fairly accurate.

ESTIMATING THE VOLUME OF RESIDENTIAL BUILDING CONSTRUCTION*

By R. R. Foster and David L. Wickens
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During the recent long period of inactivity in the construction industry—when industrial depression in the United States was being made more severe by the pronounced slump in building—it was impossible accurately to describe the real importance of construction in the national economy. Such basic questions as: How much building is going on in the United States? How does it compare with building in earlier years? Where is it taking place? could not be answered. Current statistics on the construction industry, although very valuable, were limited in their usefulness primarily to indicating the general trend of construction and to giving some suggestion of the areas in which principal building activity was under way. Now we are entering into a phase of business activity in which rapidly expanding construction is of great importance, both to government and to industry, and adequate measurements of the actual amount of building are even more essential than heretofore.

In an effort to meet this need for more accurate data on the volume of construction, we have made a new series of estimates of the amount of non-farm residential building in the United States from 1920 to 1935. This paper reviews some of the problems encountered, and describes briefly the methods by which the estimates have been made.

These new estimates show the volume of residential construction to have been notably greater during the past fifteen years than any previous estimates have shown, and emphasize its importance to general business activity. In terms of dollar volume, the peak of residential construction is estimated at four and one half billion dollars or more in 1925, rather than slightly more than three billions in both 1925 and 1928 as shown in previous estimates. For the decade prior to 1930 it appears that the total volume of residential building has been consistently underestimated by as much as 30 to 50 per cent. Our preliminary estimates for 1936 indicate that the number of new units built will fall between 280,000 and 300,000, a considerable improvement over the 1933 level but still less than a third of the peak volume of 1925.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 28, 1936.

The country's housing requirements during the decade of the 1920's, as measured by dwellings built, other than on farms, totaled approximately 7,000,000 units, or an average of about 700,000 units per year, with a peak of over 900,000 units in 1925. In contrast, at the low point of building activity, in 1933, about 55,000 dwelling units were built, or only 8 per cent of the average amount during the 1920's. Fluctuations as great as these in what is perhaps the nation's largest single industry, with widespread ramifications in other industries as well, deserve far more careful attention than they have hitherto been given.

More serious perhaps is the fact that records of building available currently during the boom of the 1920's did not make evident the fact that residential construction reached its peak as early as 1925—rather than in 1928 as has generally been assumed. Thus, the decline in volume of residential building began four years before the marked industrial decline of 1929. A more general realization of this fact would have given some warning of the industrial depression.

ESTIMATED VOLUME OF NEW RESIDENTIAL BUILDING IN THE UNITED STATES OTHER THAN ON FARMS 1920–36

Number of housekeeping units built and value of all residential building, including non-housekeeping dwellings*

Year	Number of housekeeping units†	Value of all residential construction‡	Year	Number of housekeeping units†	Value of all residential construction‡
	000's	Billions of dollars		000's	Billions of dollars
1920	230	1.1	1929	520	2.8
1921	440	1.8	1930	290	1.4
1922	720	3.2	1931	220	1.0
1923	880	4.0	1932	75	0.3
1924	890	4.2	1933	55	0.2
1925	935	4.7	1934	56	0.2
1926	865	4.4	1935	144	0.6
1927	825	4.1	1936§	280–300	—
1928	755	3.8			

* Preliminary estimates, subject to revision.

† New housekeeping units only.

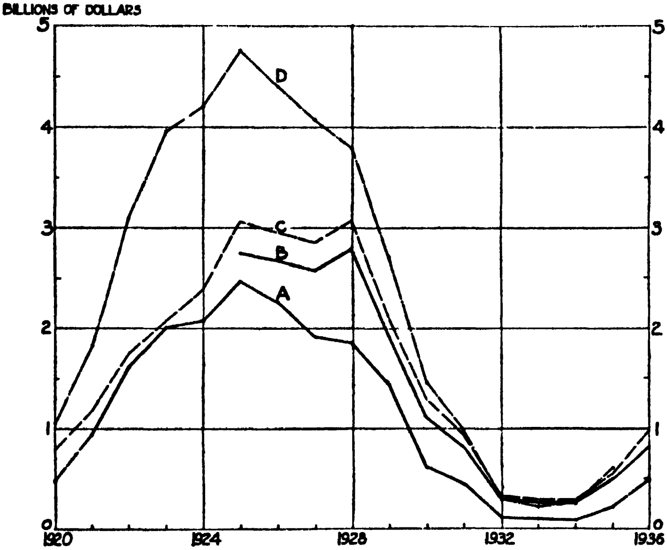
‡ Includes housekeeping and non-housekeeping dwellings (hotels, clubs, lodging houses, etc.).

§ Based on data for 11 months. Cost estimates not yet available.

The fact that a real revival of construction is now under way makes it urgent that we should not again find ourselves lacking an adequate basis for prompt analysis of current developments in construction. For this reason considerable attention has been devoted to this problem over the past two years by the National Bureau of Economic Research and the Social Science Research Council, particularly as a part of a broad study of real estate financing and economic stability.

In contrast to methods previously used in estimating the total volume of construction, these new estimates are based upon building permits rather than building contracts. Instead of raising the amount of contracts reported for a group of states by an arbitrary percentage to account for states not reported, we have used ratios of the number of dwelling units built to the increase in number of families in representative cities, and, with appropriate adjustments, have applied these ratios to the increase in number of families in areas not covered by data on building permits. Separate estimates were made for large metropolitan centers, for their suburbs, for smaller urban centers, and for villages and unincorporated areas, within each geographic region. A more detailed discussion of the volume of residential construction and the methods used will be given in a bulletin of the National Bureau of Economic Research. Some of the technical problems which have arisen in the course of the study are discussed below.

COST OF RESIDENTIAL BUILDING, 1920–1936



A. New Residential Building. Building permits in 257 cities reported by Bureau of Labor Statistics (1920 based on 189 cities).
B. Residential Contracts Awarded, 37 eastern states reported by F. W. Dodge Corporation.
C. Residential Contracts, 48 states. Contracts in 37 states raised on basis of building permits each year. Total for 37 states 1920–22 based on contracts reported in 27 states; 1923 and 1924 based on 36 states.
D. Preliminary Estimates, Total New Non-Farm Residential Building—48 states. Includes non-housekeeping dwellings.
Note: Estimates for 1936 based on data for 11 months.

Basic data for making estimates of the total dollar volume of residential building both currently and over a period of years are confined largely to two series: contracts awarded, as reported by the F. W. Dodge Corporation's Statistical Research Service, and building permits as reported by the Bureau of Labor Statistics. (See curves A and B on chart.) Other statistics on building permits are available over a considerable period of years, but do not segregate residential from nonresidential building. The data available on quantity and value of production and shipments of building materials, and on construction employment and payrolls are of limited value for estimating volume of residential construction. This discussion of problems and methods is therefore related principally to data from the F. W. Dodge Corporation and the Bureau of Labor Statistics.

The F. W. Dodge data represent reports made by that firm's commercial representatives in large and moderate size population centers on building other than on farms in the 37 states east of the Rockies, involving contracts of more than $2,000 for new buildings and $1,000 for repairs. Prior to 1930 the minimum was $5,000 for both new building and repairs. The Dodge reports therefore have not undertaken to provide information on any construction projects involving contracts below these limits. It seems probable that the total volume of contracts excluded by these limitations has been of considerable importance, especially during the 1920's. Estimates of total cost of residential building based on contracts awarded should therefore include some allowance for value of new building involved in contracts of less than $2,000 in recent years and $5,000 in earlier years.

Any estimate of total dollar valuation of contracts for the country made from the Dodge data requires an estimate for the 11 western states. However, such an estimate cannot safely be made by adding a fixed percentage to the total contracts reported in the 37 eastern states because the trend of building in the western states at times has varied widely from that of the remainder of the country.

For estimating the number of dwelling units built, from the data supplied by the F. W. Dodge Corporation, the number of dwellings in one- and two-family dwellings can be derived from the number of buildings of these types reported, but the number of dwelling units in apartments and other types of dwellings are not given. The rough approximations of units that may be made from data on square feet of floor space are not satisfactory. Thus, neither a 37-state total nor a 48-state total of family units built can be projected directly from the contract data.

The other principal source of construction data is the Bureau of Labor Statistics. This agency obtains data currently on building permits from local building authorities in nearly 2,000 cities having 2,500 or more population but reports for only about 1,500 of these cities are included in the data published monthly. Among the items furnished by the permit are, type of structure, number of units, and estimated value of proposed structure as declared by the applicant. These data give some representation in all 48 states, though the coverage is not uniform for states or regions. Also, coverage changes from time to time, in the case of cities which annex territory. There is no representation for permits in areas outside city limits, nor in places under 2,500 population, or on farms. Thus neither of the principal sources of data on construction provides a uniform coverage for various parts of the country.

For areas not covered by the Bureau of Labor Statistics, the most practical method found for estimating units built is to apply to the increase in number of families in these areas, ratios of building to increase in number of families in the reporting cities. Marked differences in rates of growth and building make necessary separate estimates for metropolitan centers, and for their suburbs, smaller cities, and rural areas within each geographic region. We estimate that in the last building boom, 70 per cent of all non-farm dwellings built were in metropolitan districts, nearly half of this amount being in the suburbs. Also, of all non-farm dwelling units built, about half were in the Middle Atlantic and East North Central regions.

In contrast to estimates of an aggregate amount of building over a period of years, based on the increase in number of families, estimates of volume for any one year cannot safely be made on the increase in families, especially since 1930. Other factors, such as credit conditions, changes in workers' income, building costs, or abnormal vacancies may have more influence on building than the increase in families in certain years. In the absence of sufficient data on these factors as they relate to building, it is possible to estimate the building volume in unreported cities on the basis of building rates in the reporting cities of similar size, using the 1930 census data on population, with modification. Such estimates are facilitated by the present segregation by size groups of the 1,500 cities for which the Bureau of Labor Statistics publishes permit data.

However, caution is needed in the use of this method. Grouping of cities by size may give quite misleading results because it averages together cities having widely differing rates of building activity and their average may not be representative of the unreported areas. This is true particularly of the group of small cities now reporting to the Bureau of Labor Statistics which is overweighted by cities which are satellites of large metropolitan centers. In the past, these satellite cities have constituted the most rapidly growing segment of the entire population. The list of cities of 2,500–5,000 population for which reports are now published includes over half of all cities of that size falling within metropolitan districts, but less than one-fourth of the isolated communities of the same size remote from the influence of large centers.

These problems encountered in estimating total building on the basis of building permits apply to volume either in terms of number of family units, or dollar valuation. Estimates of dollar volume have the additional uncertainty as to how accurately permit valuations reflect actual construction costs. Permit valuations are known to be too low in some cities where tax assessors use them for taxing purposes, or where permit fees are based on the estimated cost given in the permit. On the other hand, in boom times, permit figures may be overstated for sales purposes.

Another item of uncertainty in the permits figures is the number of permits granted, but for which actual construction is long delayed, or cancelled, or for other reasons not started. This is sometimes an important factor in certain cities.

In using the building permits series for 257 cities, as published by the Bureau of Labor Statistics, to estimate building volume over a period of years, allowance must be made for a downward bias, becoming more pronounced since 1928 or 1929. The bias is due to the fact that building permits, limited to areas within city limits, do not reflect the increasingly greater activity in the environs. Some evidence of this bias is given by real property inventory data on number of structures by year built, which show an increasing proportion of dwelling units built in the environs outside city limits of the large metropolitan cities. The bias is further indicated by estimates of total non-farm building based on the increased sample of cities in recent years, which show that the volume of all building outside the 257 cities has been increasing relative to that in the 257 cities. Thus, with the 257 cities tending to under-represent building over a period of years, and the current list of 1,500 cities tending to over-represent building, the two series should not be linked, for purposes of long-range comparisons.

In contrast to the downward bias in the permits series for 257 cities, there appears to have been an upward bias in the series of contracts awarded. Estimates of the total volume of residential building in the country based on contracts in 37 states are much below the new estimates presented herewith. Much of this difference apparently was due to the exclusion of contracts under $5,000 prior to 1930, but some may have been due to change of coverage when volume was rising rapidly in the early 1920's. Some idea of the extent of this under-reporting may be obtained by means of several rough tests. For example, if Curve "C" represents substantially the amount of building the F. W. Dodge Corporation would have reported had they covered all 48 states, a total of $22.2 billions is indicated for the 10-year period 1920 to 1929 inclusive. This total includes cost of hotels. Even if this indicated volume of construction were all in housekeeping dwellings, and the average cost per family unit were as low as $5,000, the Dodge minimum for single contracts, it would represent only 4,440,000 units for the decade. This falls considerably short of the 10-year increase of 5,500,000 in the number of occupied non-farm dwelling units reported by the Census of 1930. It is 2,560,000 units less than the probable total of about 7,000,000 units built during the decade, when allowance is made for 1,500,000 additional units built to offset demolitions, fire and other losses, and to allow for the increase in vacancy between 1920 and 1930. The exclusion of contracts under $5,000 involving many one-family dwellings would go far toward explaining the difference in trend shown by the contract and permits series.

Even if satisfactory country-wide estimates can be made from either contract awards or building permits data, difficulties arise in interpreting the results with respect to the time at which the construction work actually occurs. Both permits and contracts report a lump sum as of a given date, but the actual expenditure for materials and labor may be spread over many months. There are practically no series reporting such expenditures currently. The nearest approach is that represented by payrolls of reporting firms in the construction industry published by the Bureau of Labor Statistics. This series has only partial coverage of the industry and does not include value represented by labor performed by the individual builder or small contractor.

The problem of estimating new construction on farms either for dwellings or for all building presents greater difficulties than for construction in cities. Practically no data similar to contracts awarded or building permits are available as a current sample on farm construction. Census data on number of farms and farm families require considerable interpretation for use in estimating net requirements for new dwelling construction.

The difficulties which have been enumerated, and others encountered in estimating the volume of residential building, suggest certain desirable improvements in the available series. For example, the value of the F. W. Dodge reports on contracts awarded would be materially enhanced if coverage could be extended to all 48 states, or even if made to include only the three Pacific Coast states. Also inclusion of data on number of family units in contracts for respective types of dwellings is desirable. Maintenance of complete and uniform coverage is of prime importance.

In the case of building permits, test studies are needed to show the relation of permit valuations and actual construction costs. Local agencies should be encouraged to establish methods of reporting permits actually executed, to eliminate at least periodically, the exaggeration of permits figures due to permits granted, but allowed to lapse. In publishing building permits data, their value would be enhanced if the cities were grouped by metropolitan districts.

At present the Bureau of Labor Statistics series has only a one-third representation in the small incorporated cities, and none in the rural non-farm areas. Statewide reporting of certain minimum items on construction would provide not only more data, but would insure uniformity in the reports. Establishment of state reporting will depend to a considerable degree on an aroused public interest in housing problems, demanding zoning and building regulations beyond corporate city limits.

The reporting of farm construction would be a desirable addition to the whole body of current construction statistics. In the absence of country-wide reporting, which will extend to farms, separate data should be compiled for farms, preferably by the Department of Agriculture. This department already has an elaborate system of reporting farm data on a sampling basis which might be adapted to the item of construction.

Supplementary to any system of reporting current construction there is a growing need for the establishment of a periodic census of all real property. Census data on non-farm homes have been of the most limited and inadequate character and are available only on an irregular basis for certain 10-year intervals when obtained incidentally to the population census. During the past several years, physical inventories have been taken of the urban residential property in something more than 100 towns and cities, which aggregate about 15 per cent of the country's population, but these inventories have not been uniform in items covered. A census of real property covering the entire country at intervals not to exceed five years would provide a valuable background for correcting estimates made from incomplete data available currently. Such a census of the country's structures might desirably include items covering the size of the structure, materials of construction, date of construction, the rental value and market value as reported by the owner or occupant.

Since a large part of the country's wealth is represented by structures, and since the construction industry constitutes a major part of business activity it is clear that public agencies, both local and national, should take a more active part in the provision of factual information in this field.

THE EFFECT OF ALLOCATION OF NONRESIDENT DEATHS ON DEATH RATES*

By Forrest E. Linder
Bureau of the Census

A death rate may be defined briefly as the ratio of the number of people dying to the number of people exposed to the risk of dying. Other demographic and economic data, such as those relating to business volume, unemployment, crime, fertility, etc., may also be expressed on a per capita basis. An essential requirement for the validity of these measures is that the data included in the numerator of the ratio be collected in a manner consistent with the population base used in the denominator.

One of the greatest difficulties in obtaining such correspondence arises from the fact that the population under investigation is not static. There is a rapidly increasing tendency toward population mobility, and this has now reached the stage where many rates and other per capita measures are of limited value unless nonresident factors are considered. In addition to more constant migratory trends, there are definite seasonal shifts in population due to climatic or occupational factors. Superimposed on these are more irregular changes in population such as those created by rapidly changing economic conditions in any particular locality.

In the case of mortality and natality data the greatest shifts are those caused by temporary migration into certain localities, especially cities, in order to take advantage of hospital facilities. For this reason the deaths reported for a particular city or county include decedents who are not residents of that city or county, and are, consequently, not represented in the estimate of the number of persons exposed to the risk of dying. On the other hand, the reported deaths for a specific locality fail to include residents of that locality who have died elsewhere. A solution of this difficulty obviously requires that nonresident decedents be reallocated to their place of residence.

The Bureau of the Census was well aware of the importance of this problem as early as 1900. The first of the annual volumes, *Mortality Statistics,* published in 1906, contains a rather complete discussion of the nonresident problem and also of the difficulties of making adequate correction for this factor. However, it was not until 1918 that a table based on a reallocation of nonresidents was published. At that time the mortality registration area did not include all of the United States, and consequently the reallocation could not be complete. A similar table was published for each consecutive year up to 1931, when the nonresident tabulations were discontinued.[1]

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, Illinois, December 30, 1936.

In 1935 the Division of Vital Statistics inaugurated a new series of nonresident tabulations. The coding rules by which the reallocation is made are of primary importance in the consideration of such tabulations. The essential rules are given below:

ESSENTIAL RULES FOR ALLOCATING RESIDENTS

1. A decedent is a nonresident if the place of residence is stated as different from the place of death.
2. Decedents living more than 1 year in a community are residents.
3. Decedents in general hospitals, tuberculosis sanatoria, etc., are allocated to original place of residence.
4. Decedents in "mental" institutions, etc., are tabulated as residents of place of death.

These instructions are based on the general principle that the place of residence should be determined so that the mortality data correspond with the enumerated populations on which rates would be based. They are, of course, subject to criticism from certain points of view, and subject to future revision. But in the meantime, the effect of each on the tabulations should not be overlooked.

In coding the place of residence, the decedent is considered as a resident of his "usual place of abode." If no place of residence is given on the death certificate, the decedent must be considered as a resident of the place of death. Such omissions of original data reduce the number of nonresidents which are tabulated.

The second rule states that if a decedent has lived more than one year in a community he is considered a resident of that community even though some other place of residence is stated on the death certificate. This does not mean that a person must live a whole year in one place before he can be considered a resident. As soon as his usual place of abode is established, the person becomes a resident of that place. The third rule refers to persons moving temporarily to hospitals, and similar institutions where the length of stay is not usually of long duration. Tuberculosis sanatoria are included in this group of hospitals, because even though the length of stay may be long, the cause of death presumably originated at the place of former residence. The effect of the fourth rule must be emphasized. This rule states that decedents in institutions where the length of stay is usually long are tabulated as residents of the place of death. This applies to inmates of state mental hospitals, penitentiaries, homes for the poor and aged, etc. In order to keep mortality tabulations consistent with population figures, it is necessary to assign deaths in such institutions to the city or county in which the institution is located. However, such deaths are tabulated separately so that it is possible to obtain mortality figures for each county and city including or excluding deaths in these institutions.

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[1] Certain State Departments of Health make nonresidence tabulations. The first of these were published by the Connecticut and New York Departments of Health in 1927. According to the latest information available, eleven states now make a rather complete residence tabulation. Eight other states make a partial residence tabulation by showing deaths for cities and counties including and excluding nonresidents.

The data presented in the following discussion refer only to the seventeen states for which tabulations have been completed, and to the District of Columbia.[2] It is important to emphasize that these results are provisional. Until tabulations for all states are completed, it is not possible to include for any state deaths of residents of that state occurring in other states.

TABLE I

TOTAL DEATHS AND DEATHS OF OUT-OF-STATE NONRESIDENTS: 1935

State	Total deaths	Out-of-state nonresidents	
		Number	Per cent of total deaths
Total	346,719	8,825	2.5
District of Columbia	8,483	800	9.4
Florida	20,046	1,339	6.7
Arizona	6,077	334	5.5
New Hampshire	6,532	327	5.0
Minnesota	26,247	893	3.4
Utah	5,066	162	3.2
Maryland	21,182	621	2.9
Delaware	3,208	91	2.8
Vermont	4,777	131	2.7
Rhode Island	7,838	199	2.5
Montana	6,291	153	2.4
New Jersey	43,284	963	2.2
Connecticut	17,659	372	2.1
Washington	18,203	337	1.9
Massachusetts	50,237	885	1.8
Maine	11,024	186	1.7
Indiana	39,515	471	1.2
Michigan	51,050	561	1.1

Some idea of the numerical importance of these out-of-state residents can be obtained by determining how many out of those dying in each state were residents of other states. These data are given for each state in Table I. Florida, for example, reported 20,046 deaths in 1935. Of these 1,339, or 6.7 per cent, were residents of other states. Such states as Michigan or Indiana had very few out-of-state nonresident deaths. In all of the 18 areas under consideration here, there were 346,719 deaths, and of these 8,825, or 2.5 per cent, were residents of a state other than that in which death occurred.

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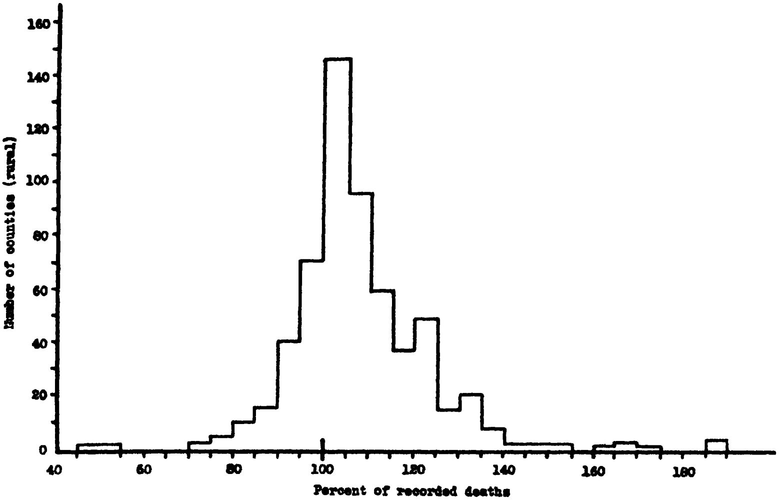
[2] The areas included are listed in Table I.

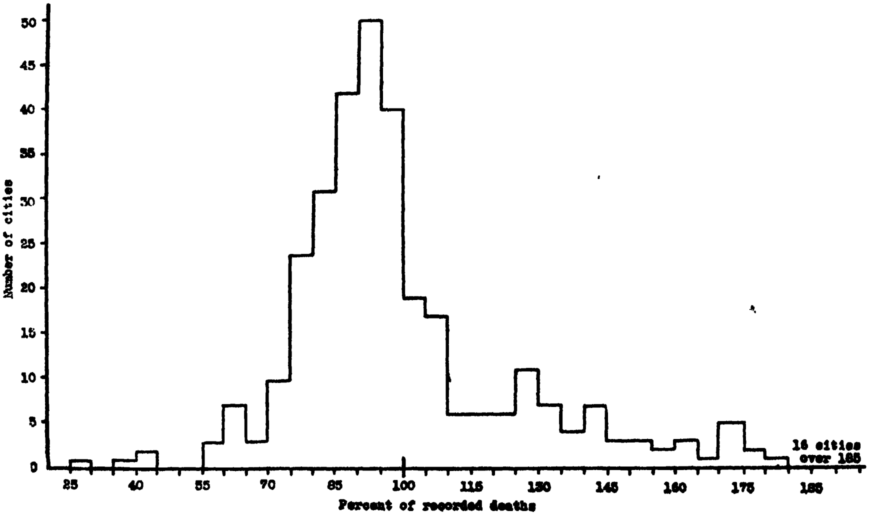
CHART I

NONRESIDENT MORTALITY IN 18 STATES: 1935

Distribution - Percent resident deaths are of recorded deaths in rural counties (out-of-state residents not included).



Distribution - Percent resident deaths are of recorded deaths in cities (out-of-state residents not included).



From the above figures it is easy to see that interstate migration, as reflected in mortality returns, is so great that the allocation of these nonresidents to the proper state is essential. This is not, however, as important as the reallocation of all nonresidents, including those who have merely moved about within a state.

In almost every discussion of the mortality nonresident problem, it is assumed that this movement within and between states consists largely of persons leaving the rural parts of counties and going to cities. Thus, it is frequently stated, that the recorded death rate is excessively high for cities and too low for the rural parts of the counties. This is generally the case but there are many exceptions.

Chart I shows the frequency distribution of the percentages that the resident deaths are of the recorded deaths for rural parts of counties. If the percentage is over 100 it means that the resident rate would be higher than the recorded rate. From this distribution it is easy to see that the recorded rate for most counties is too low, but it is important to notice that in one-fourth of the counties the recorded rate is too high. In these counties more people move into the rural part of the county to die, than move out of it.

The opposite side of the picture is also shown in Chart I. The lower graph shows the frequency distribution of percentages that the resident deaths are of the recorded deaths for cities of over 10,000 population. Here most of the percentages are less than 100, indicating that the resident death rates for those cities are less than the recorded death rates. But notice also that in over 35 per cent of the cities the reverse is true.

These distributions show that it is oversimplification to visualize the migration entirely as one from rural areas to metropolitan areas, and that it is necessary to consider the shifts from cities to rural areas, the shifts from one rural area to another, and the shifts from one city to another.

Irrespective of the direction of these movements, it is evident that the movement into a city or county seldom equals the movement out of that city or county, and that the error neglected when no allocation is made, varies greatly from city to city and from county to county.

But the importance of a study of nonresidence goes further than an examination of the net effect of reallocation. If a large number of people move into a city to die and another large number move out of the city to die, the net effect on the death rate for that city may be zero. However, this would merely be a coincidence of minor importance. The people that move out of a city go for reasons that differ from those who move into a city, and whatever the net effect on the crude death rate may be, the migration is a social phenomenon worthy of serious study.

Without attempting, therefore, to balance the nonresidents of any locality against the residents of that locality who die elsewhere, an examination can be made of the magnitude and characteristics of the group of nonresidents per se.

The total number of deaths recorded in each state and the number of decedents who were not residents of the tabulation unit[3] in which death occurred, is shown in Table II. In New Jersey, for example, 20.9 per cent of the decedents died in a city or a county in which they were not residents. Even in states which had the fewest nonresident deaths, more than 5 per cent of the recorded deaths were nonresidents. For the total area under investigation 13.4 per cent of the recorded deaths were of those not residents of the tabulation unit in which death occurred. This high percentage may be taken as an indication of the general amount of error which is neglected when no resident reallocation is made. However, the error for individual cities or counties may be far in excess of this.

TABLE II

NUMBER OF DEATHS OF PERSONS WHO ARE NOT RESIDENTS OF THE TABULATION UNIT IN WHICH DEATH OCCURRED: 1935

State	Total nonresidents	
	Number	Per cent of total deaths
Total	46,502	13.4
New Jersey	9,032	20.9
Rhode Island	1,459	18.6
Connecticut	2,834	16.0
Massachusetts	7,742	15.4
Minnesota	3,899	14.9
Florida	2,900	14.5
Utah	700	13.8
New Hampshire	887	13.6
Washington	2,454	13.5
Montana	847	13.5
Michigan	6,375	12.5
Delaware	390	12.2
Maryland	2,146	10.1
Maine	1,085	9.8
District of Columbia	800	9.4
Vermont	387	8.1
Arizona	387	6.4
Indiana	2,178	5.5

It has generally been assumed that the nonresident group consisted largely of those moving to hospitals or other institutions, and dying from certain causes. While it was not practical to make a tabulation which shows the detailed distribution of causes of death for the nonresidents, they have been tabulated in six important cause groups.

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[3] The tabulated number of nonresidents is definitely related to the size of the tabulation unit. If there is a single code number for a whole county it will not be possible to identify changes of residence within a county. In census tabulations of this material each city of 10,000 or over, and each county, exclusive of the cities, is considered a tabulation unit.

TABLE III

NUMBER OF DEATHS FROM CERTAIN CAUSES AND THE PROPORTION THAT ARE NONRESIDENTS: 18 STATES, 1935

Cause	All decedents	Nonresident decedents	Per cent nonresidents are of all decedents
Total	346,719	46,502	13.4
Tuberculosis	15,819	3,487	22.0
Cancer	38,167	5,360	14.0
Puerperal	2,649	603	22.8
Diseases of infancy	11,856	1,609	13.6
Total automobile	9,008	3,147	34.9
All other	269,220	32,296	12.0

These are shown in Table III. This table shows the number of deaths in each of the six cause groups for the total decedents, as well as the number of deaths for the nonresident decedents. The table gives also the percentage of those dying from each cause who were nonresidents. The proportion for each cause may be compared with that of the total. Thus, whereas 13.4 per cent of all decedents were nonresidents, 22.0 per cent of those dying from tuberculosis were nonresidents. It is also evident that in the case of cancer and diseases of infancy, the proportion of nonresidents is practically the same as for total deaths. The greatest percentage among these selected causes is for deaths resulting from automobile accidents. Of these, 34.9 per cent were not residents of the place of death.

The extent to which hospitalization is related to nonresidence is also of interest. Table IV shows the number of all decedents and the number of nonresident decedents dying in hospitals. The percentage of each group dying in hospitals is shown in the last two columns. For the total decedents 34.8 per cent die in hospitals, whereas in the nonresident group the percentage is 80.0.

TABLE IV

NUMBER AND PERCENTAGE OF TOTAL AND NONRESIDENT DECEDENTS DYING IN URBAN AND RURAL HOSPITALS: 18 STATES, 1935

Place of death	Number		Per cent	
	All decedents	Nonresident decedents	All decedents	Nonresident decedents
Total	346,719	46,502	100.0	100.0
Hospital	120,557	37,222	34.8	80.0
Not hospital	226,162	9,280	65.2	20.0
Total urban	205,819	32,948	100.0	100.0
Hospital	95,239	28,706	46.3	87.1
Not hospital	110,580	4,242	53.7	12.9
Total rural	140,900	13,554	100.0	100.0
Hospital	25,318	8,516	18.0	62.8
Not hospital	115,582	5,038	82.0	37.2

Needless to say, the proportions in these tables vary widely from state to state, and from rural areas to urban areas. But for every area, whether a study is being made of general mortality or of special causes, it is evident that a consideration of the nonresident group is of paramount importance.

Granting the importance of this, it does not follow that all mortality tabulations should henceforth be made on the basis of place of residence rather than place of death. Whenever such a change is made, it will create a discontinuity in the comparability of mortality statistics. Consequently, it is necessary to have a transition period during which mortality data are tabluated both by place of residence and place of death. In view of this necessity the Bureau of the Census plans to continue its tabulations based on place of death, and to supplement these with more complete tabulations based on place of residence. During the Decennial Census of 1940, it also plans, if possible, to investigate the effect of such a change upon the commonly used specific death rates. At this time a complete population base for such rates will be available. Such a study would form the necessary connecting link between the present "place of death" tabulations and the future "place of residence" tabulations.

THE ATHENS MEETING OF THE INTERNATIONAL STATISTICAL INSTITUTE

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ON THE invitation of the Government of Greece, extended at London in 1934, the International Statistical Institute held at Athens, September 27 to October 1, 1936, its twenty-third meeting, and the ninth since 1923, when the series began again after an interruption of ten years. At each session the General Assembly, or whole body of members, breaks up into not more than four sections, dealing respectively (at Athens) with demography, economic statistics, social statistics, and mathematical methods. The bulk of the work is done in the sections where (1) communications from members which have been printed and mailed in advance of the session are examined, usually after a summary explanation by the writer, and (2) reports of committees, which also have been circulated beforehand are discussed, leading in many cases to recommendations by the section to the General Assembly. Towards the end of the week, the General Assembly considers and usually adopts these recommendations. At Athens, departing from recent Institute procedure, the statistics of distribution or business, the recent developments of which are of especial interest, was considered by the General Assembly on the basis of a committee report without preliminary examination in a section.

The session received eight communications and five reports on problems in demography, nine communications and four reports on problems in economic statistics, ten communications and four reports on problems in social statistics, and five communications and two reports on problems in mathematical methodology, a total of 32 communications and 15 reports. The communications will be disregarded for lack of space, but action on the leading section recommendations calls for a summary.

Regarding *census methods in the Far East,* the General Assembly advised: that methods should be prescribed in detail by the central government; that there should be a preliminary count of dwellings; that the census should be made by enumerators carefully selected, instructed, and supervised; that the schedules should carry only demographic questions; that, if no census can be taken, an estimate of the population should be made by the representative method under a uniform plan; and that all results should be tabulated at a central office.

Regarding *death rates at high ages,* it recommended: that in censuses and registration reports particular attention should be given to returns about persons over 70 years of age; and declared that, although it could not recommend as suitable for all conditions any single method of computing such death rates, the method of graphic adjustment deserved particular consideration.

Regarding the *statistics of the number and proportion of still-born,* it recommended: that each country should adopt whatever methods seem most appropriate for getting complete statistics of births; that the definition of stillbirths proposed by the League of Nations should be adopted; that all returns of stillbirths should be accompanied by explanations about causes of error; that the deaths of those dying under 1 year of age should be classified according to age by days within the first week, by weeks within the rest of the first month, and by months within the rest of the first year; and that, regarding the figures most helpful in analyzing the statistics of living births, stillbirths, and death rates by age in the first year of life, a decision should be delayed pending further examination by the committee.

Regarding *deaths and death rates from cancer in large cities,* it recommended: that the committee's inquiry should be repeated at the time of the next census, avoiding the causes of error revealed by this preliminary investigation; that the Hygiene Section of the League of Nations and other international medical organizations should be asked to help in drafting a schedule to be filled by physicians in hospitals about each first treatment of a case of cancer and, if possible, another schedule about the outcome of the case; and that all schedules should be tabulated in a central office.

Regarding *statistics of economic cycles,* it asked its committee to prepare a further report on the index numbers which have been or should be used in order to give a correct idea of the meanings of the phrase, "economic equilibrium," as set forth in the report, and to send its questionnaire to organizations studying economic cycles or concerned with economic studies, and it urged the Director of the Institute's Permanent Office to continue, in cooperation with the Conference of Economic Services, to publish indices of economic activity for 16 important countries.

Regarding the *international statistics of motor power,* as motor power constitutes an essential element of production, as the employment of secondary motors calls for care in determining accurately the amount of power available for each branch of industry, and as it is important not to confuse motor power, as an index of capacity, with energy produced or consumed, as an index of production, the General Assembly recommended: that the statistics of motor power used in transportation (not including transportation within establishments) should be classified as follows: (a) road transportation, (b) railway transportation, (c) transportation by water, (d) transportation by air; that with reference to automobiles the statistics should indicate whether the power is reported according to some conventional measure or is the power actually produced; that the statistics should report: (a) power from different kinds of prime motors and subdivide each, distinguishing motors in use, even if unemployed at the moment, from motors in reserve or used only under special circumstances; and (b) the power of different kinds of secondary motors; that, to facilitate computation of the motor power available for each branch of industry, it is well to distinguish (a) the power of prime motors used for producing electricity from the power used for other purposes; (b) the electric power bought outside from the power produced within; that, as a measure of the power available for each branch of the industry, it is well to use (a) the power of prime motors not employed for producing electricity plus the power of electric motors, or (b) the power of prime motors plus the power of electric motors fed by purchased current minus the power sold; and that the power should be reduced to kilowatts according to a specified formula.

Regarding the *statistics of traffic accidents*, noting that a sub-committee of the League of Nations had proposed a schedule for such statistics and thinking that it does not ask for several items of information needed for international comparison, especially about proper bases for the statistics, such as population, number of vehicles used, amount of gasoline consumed, it invited the Committee on the Statistics of Transportation to consider this and other statistical questions relative to the use of accident reports, and confirmed the reference of such statistics to that committee.

Regarding *family budgets* a preliminary report and two communications were referred back to the committee.

Regarding the *organization of government statistics*, a preliminary report and a communication were discussed, and the section urged to continue the study and divide the field.

Regarding *criminal statistics*, the mixed commission's report upon the objectives, including an outline of a model report, was approved.

To deal with *international statistics of new buildings and of housing*, it was decided to set up a new committee and to ask the Bureau to enlist the cooperation of the Hygiene Section and the Economic Section of the League of Nations, the International Labor Office, the International Union of Cities, the International Federation for Town Planning, and the International Building Association.

Regarding the *statistics of gymnastic and sport societies*, it urged statistical offices to include this subject in their reports.

Regarding the *statistics of the use of radios*, as the radio has become increasingly important in social life, as all such returns as are internationally comparable should be gathered and as the Institute appreciates what the International Union on the Use of the Radio has done, especially from an international point of view, and thinks that the work should be extended, it asked the Bureau to get into touch with the International Union on the Use of the Radio and propose the establishment of a mixed commission to determine the objectives for developing international radio statistics.

Regarding *mathematical methods*, it invited the attention of statisticians to the objections to an inference often drawn in using the Bravais-Galton coefficient "*r*" as a measure of correlation and approved a series of recommendations regarding the form of statistical tables.

One privileged as I have been to attend both pre-war and post-war sessions notes certain differences between them. Until recently the Institute was substantially a child of Europe. All but one of its fourteen pre-war sessions as well as the nine sessions of its predecessor, the International Statistical Congress, were held in that continent, and the comparative failure of the one held outside Europe sounded a warning against a repetition of the experiment. The early post-war meetings at Brussels and Rome carried on this pre-war tradition, but since 1925 and apparently not of set purpose the Institute has become a world organization with sessions at Cairo, 1927, Tokyo, 1930, Mexico, 1933, and one in prospect in Washington, as well as at Warsaw, 1929, Madrid, 1931, London, 1934, and Athens, 1936.

The attendance and the quality of the communications, reports, and discussions at these sessions held outside of Europe have been on a par with those at the European sessions. This has been due almost entirely to the fact that the organization committees for the Cairo, Tokyo, and Mexico sessions, supported by their governments, were able to pay either the cost or at least the additional cost of the longer journeys.

There has been also since the War a material extension of social functions connected with the gatherings. On comparing three pre-war with three post-war sessions, it appeared that the Berlin session, 1903, arranged for an excursion to Wannsee and a banquet there; the London session, 1905, for a reception at a country house and an excursion to visit Windsor Palace; and the Paris session, 1909, for a half-day's excursion to Chantilly and a day's trip to Rouen.

At Tokyo, 1930, on the other hand, during the week there was a day's excursion to Nikko and, after the business sessions had ended, five days of excursions to Hakone, Kioto, Shiga, Nara, and Osaka; at Madrid, 1931, there was a midweek trip to Toledo, and after the sessions members and guests were entertained for two days by the city government of Barcelona; and finally at Mexico, 1933, after the sessions, there were eight days of excursions, mainly in autos, to Xochimilco, Taxco, Cuernavaea, Toluca and its volcano, Nevado, the pyramids of Teotihuacan, San Rafael, Amecameca, Pachuca, Real del Monte, and El Chico.

At the London session of 1934, although no such excursions were arranged, many members, accepting invitations from Dublin, attended the celebration of the Statistical and Social Inquiry Society of Ireland, which immediately followed the meeting in London and which, with accompanying governmental functions, filled several days.

Delightful as these opportunities have been to see a country's wonders under expert guidance, in the company of friends, and without expense, it is a question which the Institute, perhaps on recommendation of the Bureau, might consider, whether it would not conduce to improving the Institute's work if bounds were set to the generous and charming hospitality of the local committee of arrangements.

As at previous sessions the social functions at Athens were varied and brilliant. Their unique feature was that we felt, as perhaps on no earlier occasion, that we were seeing for the first time the ancient home of our civilization, for we are all the children of Hellas. On Sunday we visited the Acropolis under the leadership of the Director and participated in a tea given by the Premier and Minister for Foreign Affairs. On Monday there was an excursion to the Marathon reservoir, where luncheon was served, and a dinner by the Minister of National Economy; on Tuesday a visit to the Greek Exhibition and a dinner by the Mayor of Athens.

For Thursday evening a society of Greek ladies had organized an exhibition of Greek costumes and dances of many periods and regions; on Friday there was an excursion in motors to Delphi; on Saturday, a visit to the National Museum and in the evening a presentation of Sophocles's *Electra* in modern Greek in the theater of Herod Atticus on the side of the Acropolis. That afternoon also the members of the Bureau were received by the King.

To American members, at least, the Athens session was noteworthy because this was the first time in 80 years and the first among 32 meetings of the Institute and its predecessor, the International Statistical Congress, in which as many American members attended as appeared from any other country. Those present were Davis R. Dewey and wife, E. Dana Durand, wife and daughter, Haven Emerson, Irving Fisher, Joseph A. Hill, William F. Ogburn, Karl Pribram and wife, Stuart A. Rice, Carl Snyder, William M. Steuart and wife, Walter F. Willcox and sister; and three guests, Dr. Halbert L. Dunn, Miss Elizabeth C. Tandy, and Miss Jessamine S. Whitney. Before the War the average attendance of American members at sessions in Europe was less than two per meeting; since the War and excluding the Mexico and Athens meetings, for which traveling expenses were paid, their average attendance was two per meeting. At Mexico five and at Athens eleven were present.

NOTES

AUTOMATIC CHECKS IN CORRELATION ANALYSIS

The purpose of this note is the presentation in systematic form of a series of "automatic" or "mechanical" checks upon all of the basic statistical operations of multivariate analysis, from the sums of the original series, as they are to be used in the analysis, up to *and including* all the simple intercorrelations. No checks are suggested for the operations of "deflation" or elimination of seasonal or secular variation. It is assumed that the data are accurately presented in whatever form it is desired to correlate them.

No algebraic contribution is contained in this note. None of these checks is in any proper sense original. It is believed, however, that not all of them have ever been combined into a single tabular system, and the evidence is clear that competent statisticians are today using checks which are at the same time more complex and less satisfactory because these have not been called to their attention.[1]

Consider a set of N observations on each of n variables x_1, x_2, $x_3, \cdots, x_n$, $(N>n)$.

Let Σ denote summation over all of the N observations. (Thus there will be N terms in Σx_4, in $\Sigma x_2 x_5$, etc.)

Let S denote summation over all possible *permutations* of the indicated literal subscripts. (Thus $S(\Sigma x_i) = \Sigma x_1 + \Sigma x_2 + \cdots + \Sigma x_n$, i taking all values from 1 to n. Also $S(\Sigma x_i x_j) = \Sigma x_1^2 + \Sigma x_2^2 + \cdots + \Sigma x_n^2 + 2\Sigma x_1 x_2 + 2\Sigma x_1 x_3 + \cdots + 2\Sigma x_{n-1} x_n$, i and j taking in turn all values from 1 to n.) However, $\underset{i<j}{S}(\Sigma x_i x_j)$ will exclude all the sumsquares and half the summed cross products.

We require also a sumvariate $x_s (= x_1 + x_2 + \cdots + x_n)$ obtained by summing all of the n variables for each observation. Thus there are N "observations" of x_s.

The following definitions are expressed in terms familiar to all, and require no explanation.

$$M_{x_i} = \frac{\Sigma x_i}{N}\,; \quad M_{x_i^2} = \frac{\Sigma x_i^2}{N}\,; \quad \sigma_i^2 = \frac{\Sigma x_i^2}{N} - \left(\frac{\Sigma x_i}{N}\right)^2; \quad M_{x_i x_j} = \frac{\Sigma x_i x_j}{N}\,;$$

$$p_{ij} = \frac{\Sigma x_i x_j}{N} - \frac{\Sigma x_i}{N} \cdot \frac{\Sigma x_j}{N}\,; \quad r_{ij} = \frac{p_{ij}}{\sigma_i \sigma_j}\,; \quad p_{ii} = \sigma_i^2 .$$

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[1] Checks similar to several of those here presented may be found scattered through the literature of correlation method. See, for example, Mordecai Ezekiel, *Methods of Correlation Analysis*, Wiley & Sons, New York, 1930, pp. 539 ff., and Ragnar Frisch, *Statistical Confluence Analysis by Means of Complete Regression Systems*, Universitetets Økonomiske Institutt, Oslo, 1934, pp. 12 ff.

We are now ready to set up two tables, the first of n rows and nine columns; the second of ${}_nC_2$ rows and five columns.

TABLE I

Column Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Column Content	Σx_i	Σx_i^2	M_{x_i}	$M_{x_i^2}$	$M^2_{x_i}$	σ_i^2 $=(4)-(5)$	σ_i $=\sqrt{(6)}$	$\dfrac{p_{i1}+p_{i2}+\cdots+p_{in}}{\sigma_i}$	$\sigma_i(r_{i1}+r_{i2}+\cdots+r_{in})$
x_1 x_2 • • • x_n									
Column Totals	$S(\Sigma x_i)$	$S(\Sigma x_i^2)$	$S(M_{x_i})$	$S(M_{x_i^2})$	$S(M^2_{x_i})$	$S(\sigma_i^2)$	$S(\sigma_i)$	$S(p_{ij}/\sigma_i)$	$S(\sigma_i r_{ij})$
x_s	Σx_s	Σx_s^2	M_{x_s}	$M_{x_s^2}$	$M^2_{x_s}$	σ_s^2			

Columns (8) and (9) of Table I will be explained after Table II has been constructed. At the foot of Table I the penultimate row contains the sums of the n quantities in each column. The last row is obtained by treating the sumvariate x_s exactly as was each of the n variates in the body of the table.[2]

TABLE II

Column Number	(10)	(11)	(12)	(13)	(14)	(15)
Column Content	$\Sigma x_i x_j$	$M_{x_i x_j}$	$M_{x_i} M_{x_j}$	$p_{ij}=(11)-(12)$	$\sigma_i \sigma_j$	$r_{ij}=(13)+(14)$
x_1x_2 x_1x_3 • • x_1x_n x_2x_3 • • x_2x_n • • $x_{n-1}x_n$						
Column Totals	$\underset{i<j}{S}(\Sigma x_i x_j)$	$\underset{i<j}{S}(M_{x_i x_j})$	$\underset{i<j}{S}(M_{x_i} M_{x_j})$	$\underset{i<j}{S}(p_{ij})$	$\underset{i<j}{S}(\sigma_i \sigma_j)$	

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[2] Since the computations upon the sumvariate add nothing to our knowledge of the original set of variables under analysis, the best checking procedure would seem to be that which provides an adequate verification of all work, yet minimizes the number of operations performed upon the sumvariate. Here we require only the N sums x_s, the N squares x_s^2, and the six operations indicated at the foot of the

Columns (8) and (9) are set up solely to check column (15). For the first entry in column (8), the sum of all the product-moment coefficients having one as either subscript, including $p_{11}=\sigma_1^2$, must be found, and this total divided by σ_1. Similarly the second entry is computed by summing all the p's having a two as either subscript, including $p_{22}=\sigma_2^2$, and dividing this sum by σ_2, etc.

For the first entry in column (9), the sum of all simple correlation coefficients having one as either subscript, including $r_{11}=1$, must be found, and this total multiplied by σ_1. Similarly the second entry is computed by summing all the r's having two as either subscript, including $r_{22}=1$, and multiplying this sum by σ_2, etc.[3]

It follows therefore that the sum of column (8) is simply $S(p_{ij}/\sigma_i)$ and that of (9) simply $S(\sigma_i r_{ij})$.

The following "automatic" checks will verify every entry in each table. (In these checks [a] will denote "the sum of column (a).")

I $\Sigma x_s = [1]$
II $\Sigma x_s^2 = [2]+2[10]$
III $M_{x_s} = [3]$
IV $[4] = (1/N)[2]$
V $M_{x_s^2} = [4]+2[11]$
VI $M^2_{x_s} = [5]+2[12]$
VII $\sigma_s^2 = [6]+2[13]$
VIII $[11] = [12]+[13]$
IX $[7]^2 = [6]+2[14]$
X $[8] = [9]$ (Checks column 15)

The following suggestions as to order of procedure will be found helpful in using these tables and checks. Fill in all of the spaces in one column before proceeding to the next column.

Fill in column (1) and apply check I.

Fill in columns (2) and (10) and apply check II.

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first six columns of Table I. Ezekiel's checks (op. cit), which incidentally do not verify the zero order correlations, require in addition the Nn multiplications necessary to obtain $\Sigma x_1x_s, \Sigma x_2x_s, \cdots, \Sigma x_nx_s$. Frisch (op. cit., p. 12) declares against the calculation of these n additional product-sums, but on the following page calls for the calculation of quantities s_{is} by his equation (1.9) which can only mean, in our notation, obtaining $N\Sigma x_ix_s - \Sigma x_i \Sigma x_s$ for each i from 1 to n.

[3] The use of the zero order correlations in the determination of multiple regression or correlation constants by means of modifications of the familiar "Doolittle Solution" has been discussed recently by F. V. Waugh, "A Simplified Method of Determining Multiple Regression Constants," this *Journal* Vol. XXX, December, 1935, pp. 694–700, and also by A. K. Kurtz, "The Use of the Doolittle Method in Obtaining Related Multiple Correlation Coefficients," *Psychometrika*, Vol. I, March 1936, pp. 45–51. These and similar systematic solutions contain a "sum and check" column at the right, in which are placed the sums $r_{i1}+r_{i2}+\cdots+r_{in}$ of the coefficients which enter into each of the normal equations. In computing the entries in column (9) Table I of this paper, all of these sums are obtained. Consequently the *additional* labor involved in checking column (15) is even less, when a Doolittle solution is the next operation.

Fill in columns (3) and (4) and apply checks III and IV.
Fill in columns (11), (12) and (5) and apply checks V and VI.
Fill in columns (6) and (13) and apply checks VII and VIII.
Fill in columns (7) and (14) and apply check IX.
Fill in columns (15), (8) and (9) and apply check X.

VERIFICATION OF THE CHECKS

The proofs of these checks involve only the most elementary algebra and will be familiar to most readers. However, their presentation is greatly simplified by the use of the summation notation here employed, and they are given to make this note completely self-contained.

By definition, $x_s = x_1 + x_2 + \cdots + x_n$, whence

$$\Sigma x_s = S(\Sigma x_i) . \qquad \text{I}$$

Obviously $\Sigma x_s^2 = S(\Sigma x_i x_j)$; but

$$S(\Sigma x_i x_j) = S(\Sigma x_i^2) + 2 \underset{i<j}{S} (\Sigma x_i x_j) . \qquad \text{II}$$

If we divide both sides of the equation of check I by the number of observations, we have

$$M_{x_s} = S(M_{x_i}) . \qquad \text{III}$$

Since the sum of the means is the mean of the sums, we have

$$S(M_{x_i^2}) = \frac{S(\Sigma x_i^2)}{N} \cdot \qquad \text{IV}$$

Continuing the use of this same notation,

$$\begin{aligned} M_{x_s^2} = (1/N)\Sigma x_s^2 = (1/N)S(\Sigma x_i x_j) &= S(M_{x_i x_j}) \\ &= S(M_{x_i^2}) + 2 \underset{i<j}{S} (M_{x_i x_j}) \end{aligned} \qquad \text{V}$$

And likewise,

$$M^2_{x_s} = S(M_{x_i} M_{x_j}) = S(M^2_{x_i}) + 2 \underset{i<j}{S} (M_{x_i} M_{x_j}) . \qquad \text{VI}$$

By definition,

$$\sigma_s^2 = M_{x_s^2} - M^2_{x_s} = S(M_{x_i x_j}) - S(M_{x_i} M_{x_j})$$

or

$$\begin{aligned} \sigma_s^2 &= S(M_{x_i^2}) - S(M^2_{x_i}) + 2 \underset{i<j}{S} (M_{x_i x_j}) - 2 \underset{i<j}{S} (M_{x_i} M_{x_j}) \\ &= S(\sigma_i^2) + 2 \underset{i<j}{S} (p_{ij}) . \end{aligned} \qquad \text{VII}$$

Since the sum of the differences is the difference of the sums, we have

$$\underset{i<j}{S}(p_{ij}) = \underset{i<j}{S}(M_{x_ix_j}) - \underset{i<j}{S}(M_{x_i}M_{x_j}) . \tag{VIII}$$

Expanding,

$$\{S(\sigma_i)\}^2 = S(\sigma_i\sigma_j) = S(\sigma_i^2) + 2\underset{i<j}{S}(\sigma_i\sigma_j) . \tag{IX}$$

Finally,

$$S\left(\frac{p_{ij}}{\sigma_i}\right) = S\left(\sigma_j\frac{p_{ij}}{\sigma_i\sigma_j}\right) = S(\sigma_j r_{ij}) .$$

Since $r_{ij} = r_{ji}$,

$$S(\sigma_j r_{ij}) = S(\sigma_i r_{ij}) . \tag{X}$$

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THE ANALYSIS OF INTERNAL MIGRATION IN THE SWEDISH CENSUS OF 1930

By Dorothy Swaine Thomas
Yale University

In view of the possibility that a question on internal migration may be included in the schedule for the United States census in 1940, it is appropriate to examine the Swedish experience in incorporating such a question in their 1930 census schedule.[1]

Up to the time of the 1930 census, Swedish official interest in internal migration was confined to two sorts of analyses:

(1) A yearly record of migrants to and from each community, summarized and published for larger administrative areas, and used in conjunction with records of births and deaths to compute the population as of the last day of every calendar year. In this analysis migrants have been classified by sex and internal migrants separated from immigrants and emigrants, but no breakdown by age or other demographic characteristics, or by direction of migration has been possible.

(2) A decennial analysis of the resident population in terms of birthplace. These data have been analyzed in considerable detail in the census reports since 1860, and throw light on the general direction of the main migration streams and the amount of population redistribution, but have proved to be quite unsatisfactory for any analysis of the dynamics of migration or the characteristics of the migrants at the time of migration.

By 1930, a general appreciation of the importance of internal migration, of what was felt to be its profound effects not only on the economic development of the country but also on the trends of nativity and mortality, and a widespread impression that the fundamental nature of these migrations was changing rapidly led to the inclusion of a special question in the census schedule relating to the *date of last migration into the community of present residence and the name of the community of residence immediately preceding this migration.*

METHOD OF DATA COLLECTION AND PLAN OF TABULATION

The 1930 census followed the tradition of all preceding censuses since 1860, in being primarily an *indirect* census, i.e., a balance sheet drawn from the continuous population registers whereby the status of the resident population on the last day of the decade is indicated. This indirect approach was, as usual, supplemented by a number of questions on the tax declaration schedule required of every householder (to be filled in for all the members of his household) covering points not included in or not readily obtained from the population registers. The collation of these two records provided the basic data for the census.

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[1] **Sveriges Officiella Statistik: Folkräkningen, den 31 december 1930. II. Bygdeindelning. Folkmängden efter ålder, kön och civilstånd. Inrikes omflyttning (inkl. fördelning efter födelseort) Stockholm, 1936.**

The population registers had one serious limitation in providing the complete information called for by this question. Although the registration form has one column for the date of migration into the community and another for the name of the community of previous residence, the latter is usually filled in only for persons migrating into the community during the period for which a particular set of registers is set up. The registers are renewed every ten years, following the census, and in the transcript of the "survivors" from the old ledger (persons who have neither migrated from the community nor died), a folio reference to the old ledger is usually given instead of the name of the community of previous residence. In the census of 1930, persons migrating into a community between January 1, 1921, and December 30, 1930, could be identified[2] in the current register in terms of the community of previous residence, but in-migrants during the (preceding decade could be so identified only by tracing back a folio reference to the preceding register, and the tracing of in-migrants of several decades ago, through a series of registers, would have involved an impossible clerical burden. For this reason, an especial effort was made to obtain the required data with reasonable accuracy for all persons whose last migration to the community of present residence occurred between 1921 and 1930, and the main tabulations are based on this limited period. A still further limitation to the years 1926–1930 was considered necessary for analyzing age and occupations because these data refer to status, as of December 31, 1930, and not to status at the time of the last migration.

The tabular and analytical framework is geographical, and an understanding of the types of areas used is essential to an appreciation of the meaning of the results. The smallest administrative unit is the *community*, of which there are about 2500; 118 of these communities have received royal charters as *towns;* the others are called *rural areas,* irrespective of their size. The communities are grouped together, for certain local governmental and administrative purposes, into 288 *districts* (härad), and the districts, in turn, are grouped into 24 *counties* (län) plus the city of Stockholm.

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[2] The tracing was a difficult matter even for a number of the migrants of 1921–1930 for the registers are usually organised on an address basis. Persons moving frequently *within* the community may be shifted from folio to folio in the same volume with the same trouble of identification of community of preceding residence as if they had migrated into the community during a preceding decade. This difficulty is eliminated in Stockholm, but only since 1926, when a card system was so organized that an individual's whole record is shifted from one address to another.

The community is the unit for population registration, hence, internal migration means inter-community changes of residence. The county is the most usual tabulation unit, each county being divided into rural areas and towns. Tabulations were formerly made in terms of districts also, but this unit was discontinued in the primary population tables in 1920, presumably for reasons of economy.

In the present census, the heterogeneity of the county was recognized, and a non-administrative unit, the *region,* (bygd) was used to assemble and even to cut across district lines, if the classification could thereby be improved, but never to cut across county lines. Thus the comparability of the data with past censuses was preserved and at the same time more significant differentiation was made possible. The criteria (which are not described in the census volumes published to date) are said to be those of economic geography. The regions number 132.[3]

RESULTS

The main results, as analyzed in the census volume, may be summarized briefly, as follows:

1. *Origin and Destination of Migrants:* Half of those whose last migrations occurred between 1921 and 1930 moved from one rural area to another. When the number of migrants from each area is expressed as a proportion per thousand mean population 1921–1930, the following results emerge:

		0/00 mean population I (rural areas)		
		Males	Females	Total
I	Migrated from one rural area to another	190	197	193
	Migrated from rural area to town	74	99	87
	Total migrated from rural areas	264	296	280

		0/00 mean population II (towns)		
		Males	Females	Total
II	Migrated from town to rural area	122	132	127
	Migrated from one town to another	105	116	111
	Total migrated from towns	227	248	238

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[3] Four of the regions include one large city each; 84 include both rural areas and one or more towns and 44 include only rural areas. In one case the region includes one whole county; in 24 cases one whole district; 4 cases, as indicated, one whole city; in 41 cases it cuts across district lines; and the remaining 62 regions comprise 2 or more whole districts each.

It should be noted that the proportions are consistently higher for rural areas than for towns and for females than for males.

When the data are thrown into regional classes, migrations from one rural area to another are found to be predominantly intra-regional (short distances) whereas migrations between towns are predominantly inter-county (long distances).

2. *Areas of Absorption and Dispersion:* By comparing in- and out-migrants to and from different regions, areas of absorption and dispersion are determined. Although towns in general would be expected to be absorption areas, 35 of 88 town regions show losses and are, by definition, dispersion areas and, if intraregional migrants are excluded, no less than 58 are dispersion areas. This is probably due to the drawing power of the largest cities over other towns. As expected, most rural regions are areas of dispersion: Only 16 out of 128 are absorption areas, if all moves are taken into account and, if intra-regional moves are excluded, a total of 25 rural regions become absorption areas.

Each region is analyzed for its contacts with other regions in detail separately for each sex to show the 8 regions from which it draws the greatest number of in-migrants, and the 8 to which it sends the greatest number of out-migrants. From this tabulation, one can determine the steps in the migration process: Stockholm, the metropolis, is the direct goal for migrants from many regions; from other regions, the migrations proceed in shorter stages toward the same eventual goal. Stockholm is the area of absorption for its inner suburban region, the latter is an absorption area for the outer suburban region and the coastal region, and this last is, in turn, an area of absorption for its neighboring regions.

The general demography of rural dispersion and absorption areas is examined to throw light on some of the possible demographic effects of migration. This analysis embraces the 16 rural absorption areas subdivided into "suburban areas" and "other rural areas," compared with 21 rural areas where the dispersion amounted to at least 60 0/00 of the mean population. It covers the following main points:

(a) The extent to which rural communities are "agglomerated" (agglomerated means that at least two-thirds of the population lives around a compact, village-like center).
(b) Proportion of agricultural workers and their dependents to total population.
(c) Age distribution.
(d) Sex ratio.
(e) Married women aged 15–45 per 1000 inhabitants.

(f) Birth rate and married fertility rate
(g) Death rate.

Striking differences between absorption and dispersion areas are shown in regard to all of these factors, absorption areas being highly agglomerated, having low proportions of agricultural workers, high proportions of young adults, high proportions of females, high proportions of married women, a somewhat high birth rate, low married fertility, and low death rate compared with dispersion areas.[4]

The movement of population is, in general from areas of high fertility to those of lower.

(3) *Duration of Residence:* The data are analyzed by year of in-migration. At the time of the census one-third of all migrants (including those migrating before 1921) had lived in the community of present residence less than five years and one-half less than ten years. The nature of the question asked on the schedule makes for a tendency toward decrease in the number of migrants from the census date backward due to death and repeated migration.

(4) *Age and Occupation of Migrants:* As indicated above, this analysis was limited to persons whose last migration occurred between 1926 and 1930.

The age analysis is made in considerable detail with a warning that the average age-displacement in the data amounts to two years. Important differences are shown between areas of absorption and dispersion the latter, on the average, drawing younger migrants than the former due chiefly to the influx of agricultural labor to dispersion areas.

CRITIQUE

The 1930 Swedish census approach to internal migrations represents an improvement on the usual approach in terms of place of birth and place of residence, for the latter always seems to imply that the first migration from the place of birth leads to settlement, and that a cross section analysis at any point of time will indicate the streams of migra-

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[4] The main specific results were, in brief, as follows:

		Rural absorption areas	Rural dispersion areas
Agglomerated population	0/00 population	520	186
Agricultural workers and dependents	0/00 population	283	502
Ages 15–30	0/00 males	275	263
	0/00 females	261	232
Females per thousand males (Ages 15–30)		928	850
Married women aged 15–45 per thousand population		111	99
Birth rate (1929–1932)		15.9	15.6
Marriage fertility rate (1929–1932)		117.5	135.2
Death rate (1929–1932)		11.1	12.7

tion. It cannot, by its very nature, take account of migrants returning to their birthplaces, or of migrants whose present residence is but one of a series of moves. The present analysis, being confined to the last migration, cuts across this series at various points and probably gives a more realistic picture of the process of migration, since the community of destination (present residence) can in all cases be tied up with the community where the last migration originated (previous residence).

The best aspects of the analysis are undoubtedly those which relate migrations to economic geographical structure on a regional basis and permit an empirical definition of areas of absorption and dispersion. The demographic differences found in these regions are enlightening, and the close relationship between mobility on the other hand and nativity and mortality on the other is strongly indicated. This analysis also enables an approach to be made to the selective aspects of migration, in which the variables of distance and community structure play an important role.

The analysis is, however, handicapped throughout by one serious defect inherent in the data, i.e., that the migrants for every year included differ from those for every other year. The migrants for 1930 give a pretty complete representation of the migration process for that year, the only exclusions being the migrations of those who migrated and died during the same year and the preceding migrations of those who migrated two or more times during the year. But 1929 excludes one other group, i.e., those who migrated again in 1930; 1928 excludes those who migrated again in 1929 and 1930, etc. In other words, the further from the census date, the greater the selection of "migration survivors." The strength of this selection is indicated by the following table, where migrants for each year from 1921 to 1930 are expressed as a percentage of the total for the ten years.

Year of in-migration	Per cent of all in-migrants	Year of in-migration	Per cent of all in-migrants
1930	21.7	1924	7.6
1929	14.5	1923	6.9
1928	11.6	1922	5.6
1927	9.9	1921	5.2
1926	8.8		
1925	8.2	Total	100.0

It is obvious that, even allowing for the influence of secular trend and cyclical variations in the number of migrants, and in their mortality repetition of migration has had an enormous influence in reducing the numbers included in all years except the last.

To solve this difficulty it would be necessary to obtain a complete cross-section of migrants for a sufficiently large number of years to allow for the influence of trends and cycles, or a longitudinal record of the successive steps in the migration history of a sufficiently large number of individuals. Neither of these approaches can reasonably be considered appropriate as a census procedure.

Recognizing the limitations of the question as phrased in the Swedish census, what is a possible alternative? The question generally proposed for use in the 1940 United States Census is of the general form. "Where did you reside at the time of the 1930 census?" Its most obvious advantage is the relative ease with which the data could be tabulated. Time is held constant, and the tabulations would easily fall into the form of the place-of-birth—place-of-residence analyses. A picture of the general shifts in population distribution would result, but nothing would be known about the time at which migration occurred. Migrants returning to their previous place of residence would not enter the record, and no trace would be left of the migrations originating and terminating during the years intervening between 1930 and 1940.

Accepting the necessary limitations, both of the question used in the Swedish Census and this proposed question for the United States Census, one further point becomes important: "Which of these questions is likely to produce the most reliable answers?" The Swedish experience throws no light on this point, for the census was not taken by direct questioning, and the defects in the data were due entirely to the form in which the population registers are kept. A preliminary experiment with both forms of questions would definitely be worth while to determine whether people in general can give more reliable information about their last place of residence and the date of the change of residence or about their place of residence at a given point of time.

It will be important to be able to depend on the data that are obtained, for, even with the limitations noted, the inclusion of a question on internal migrations in the census schedule is likely to be the only systematic approach to this problem that we can hope for in the near future.

MOVEMENTS OF MAIL-ORDER PRICES

Sales of mail-order houses constitute a substantial proportion of the total volume of retail trade in the United States. Much of the buying of farmers, in particular, is done through the large mail-order companies. Yet none of the index numbers by means of which we trace changes in the average prices paid by final consumers includes mail order quotations. If the movements of mail-order prices differ from those of the price series used in constructing current index numbers of retail prices, these index numbers may not be accepted as accurate measures of changes in prices paid by consumers at large.

Some light is cast on these matters by index numbers constructed from selling prices in the catalogs of Sears, Roebuck and Company over the period 1923–1936.[1] Comparable price quotations on 210 articles are available for the period 1929–1936. For the period 1923–1929 quotations on 145 articles are available. Since the records for the earlier period are less comprehensive, the price movements of the two periods are shown separately in the following table. The index numbers are unweighted geometric averages of relative prices.

Comparison with other measurements of price changes over these periods reveals a number of interesting differences. From 1923 to 1929 the mail-order prices included in the above index numbers declined, at a rate markedly greater than those prevailing among wholesale and retail prices in general. From 1929 to 1933 there was no great divergence of the different index

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[1] The quotations have been secured through the courtesy of Mr. D M. Nelson, Vice President of Sears, Roebuck and Company, in charge of Merchandising. Mr. Nelson states that the prices given relate to items "in which the selling price can be compared from year to year with a reasonable degree of accuracy because of the similarity of the items in the years covered. There has been no substantial change in quality in the items included in this list."

The commodities on which quotations are given for the period 1929–1936 include:

Commodity	Series	Commodity	Series
Cotton piece goods	19	Farm equipment, appliances	13
Cotton towels	4	Farm equipment, incubators and brooders	4
Cotton blankets	2	Farm equipment, fencing, etc.	12
Cotton underwear	8	Furniture	14
Cotton work shirts	5		
Cotton overalls and pants	9	Floor covering, wool	8
		Floor covering, felt base	5
Silk piece goods	8		
Silk hosiery	2	Electric appliances	8
		Household furnishings	8
Rayon piece goods	2		
Rayon lingerie	7	Leather, shoes	10
		Leather, harness	10
Linen piece goods, etc.	4	Rubber, footwear	8
		Rubber, automobile tires and tubes	10
Woolen blankets	1	Rubber, garden hose and belting	3
Woolen underwear	4		
Woolen men's clothing	5	Stoves and heaters	8
Enamelware	9	Total	210

numbers. Mail-order prices rose sharply from the spring of 1933 to the spring of 1934, paralleling and in some cases exceeding the general rise. Thereafter, to the fall of 1936, during a period of general advance in both wholesale and retail prices, the mail-order series here represented showed an average decline of 11 per cent.

INDEX NUMBERS OF MAIL-ORDER PRICES
FALL 1923–FALL 1936
(BASED UPON SEARS, ROEBUCK AND CO. PRICE QUOTATIONS)

Catalog	*Fall 1923 = 100*				
	All commodities (145 series)	Textiles (55 series)	Furniture and furnishings (43 series)	Farm equipment (20 series)	Other (27 series)
Fall 1923	100.0	100.0	100.0	100.0	100.0
Fall 1924	95.6	99.0	91.9	93.7	96.9
Fall 1925	92.3	94.3	88.0	92.0	96.1
Fall 1926	89.7	89.0	84.1	88.7	102.1
Fall 1927	83.3	80.7	80.8	86.1	91.1
Fall 1928	81.9	81.3	74.9	84.8	93.1
Fall 1929	81.6	80.5	75.8	92.5	86.1

Catalog	*Fall 1929 = 100*				
	All commodities (210 series)	Textiles (80 series)	Furniture and furnishings (60 series)	Farm equipment (29 series)	Other (41 series)
Fall 1929	100.0	100.0	100.0	100.0	100.0
Fall 1930	94.7	90.5	98.8	93.1	98.2
Fall 1931	85.5	78.4	91.9	88.6	88.8
Fall 1932	72.3	61.8	80.5	79.9	78.1
Spring 1933	71.1	59.3	77.6	79.4	77.0
Fall 1933	77.1	69.7	83.4	82.1	80.4
Spring 1934	84.6	80.3	89.2	86.3	85.2
Fall 1934	79.5	78.5	80.3	87.9	74.7
Spring 1935	73.8	67.6	75.2	83.7	74.7
Fall 1935	75.9	71.9	76.0	87.3	75.1
Spring 1936	75.0	67.9	79.5	85.6	74.7
Fall 1936	75.4	68.2	77.5	87.5	79.1

No other series of index numbers is strictly comparable with the mail-order measurements given above. The data are of exceptional interest, however, for they represent a highly important market not covered in the compilations currently available to students of prices. Since their movements appear to differ from those of prices in the markets represented in existing retail price indexes, there is the more reason for seeking to extend mail-order price records, and to utilize them to the full.

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IMPROVEMENT OF GOVERNMENT PERSONNEL

A session on problems connected with securing better personnel in the Government service was held under the joint auspices of the American Statistical Association, the American Economic Association, and the American Farm Economic Association at the convention meetings in Chicago. The report of the Commission of Inquiry on Public Service Personnel[1] invited the various professional associations to continue the study and discussion of the program it had outlined. It was in response to this invitation that the program was arranged. Papers were presented by Professor William E. Mosher, Director of the School of Citizenship and Public Affairs of Syracuse University; Professor Leonard D. White, Civil Service Commissioner; and Dr. Isador Lubin, Commissioner of Labor Statistics.

Professor Mosher's paper, entitled "A Critique of Federal Personnel Policy as Applied to Professional Social Science Positions," discussed the emphasis which still exists in the Civil Service Commission on a negative policy of maintaining bulwarks against political raids. Professor Mosher urged the necessity for supplementing this program with an aggressive recruitment system which would acquaint desirable applicants with the attractive opportunities for research work in the Government. He also discussed the need for improving both the written and unassembled examinations of applicants through greater emphasis on quality rather than quantity of experience, through fuller application forms, and through requiring applicants thoroughly to substantiate their claims of professional experience instead of being given the benefit of the doubt when sketchy statements are submitted.

Professor Mosher complimented the Commission on encouraging the development of a program of "career service" in the Federal Government. Such a program must of necessity involve close cooperation between appointing agencies and the Commission, and points directly to the Commission's need for a larger staff of highly competent persons.

Commissioner White, who came to the Civil Service Commission from the Political Science Faculty of the University of Chicago, in a paper entitled "New Opportunities for Economists and Statisticians in Federal Employment" discussed the extraordinary growth in the number of positions filled by economists and statisticians in the Federal service since the beginning of the century. He noted that classified and unclassified positions may be of three main types: those primarily research in character, advisory or part-time positions, and those primarily administrative but requiring a broad knowledge of the social sciences. Many of these positions, he pointed out, afford ample opportunities for trained economists and statisticians in numerous salary ranges. He explained that the Commission holds written examinations in the social science fields as a rule only in the lower salary brackets, whereas those in the higher salary ranges usually consist of the so-called "unassembled examinations" in which the applicant presents a detailed sworn statement regarding his education and professional experience. He made clear that the Civil Service Commission recognized the recruitment problems outlined by Professor Mosher and that efforts are being made to attract highly competent people and to emphasize quality of education and experience in their examinations.

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[1] *Better Government Personnel*, McGraw-Hill Book Co., New York, 1935. A summary of the report appeared in the June, 1935, issue of this JOURNAL.

"Government Employment as a Professional Career in Economics" was discussed by Commissioner Lubin, of the Bureau of Labor Statistics. Despite the belief in certain circles that Government positions are accepted only as a last resort, Dr. Lubin stated that actually a condition almost opposite to this has often developed. He pointed out that colleges and universities have suffered an embarrassing drain on their faculties during the recent exodus of social scientists into the Federal service. Dr. Lubin noted that during the last twenty years many highly competent research organizations have developed in a number of the bureaus. He gave it as his opinion that the research carried on in these agencies is usually of at least as high a caliber as that obtaining in academic circles and that the pressures on academic freedom are probably no greater than those exerted in university circles by department heads, presidents, the state legislature and the press. He called attention to the abundant opportunity for independent research in close contact with vast sources of basic data and with other persons interested in research problems, and to the fact that Government salaries compare favorably with those in colleges and universities.

DONALD C. RILEY

Central Statistical Board

PROGRESS OF WORK IN THE CENSUS BUREAU

PRESENT STATUS OF WORK ON POPULATION ESTIMATES

For the first nine months of the year 1936 there were two men in the Population Division working on the technical problems of making population estimates for states and cities on the basis of available local data. Fairly satisfactory estimates of the population of states on July 1, 1934 and 1935, were worked out on the basis of school enrollment figures and other local data, supplemented by the 1935 farm population data obtained from the farm census. Work was begun on making estimates for cities. Local information was collected for a considerable number of cities and much was done toward establishing a standard method for using such information. Estimates of the 1935 population of the United States distributed by age and sex were practically completed. In September both of these men resigned and the Census Bureau has not yet succeeded in filling their places. So at present very little progress is being made on the more difficult problem of estimating population for cities.

The estimates of the total population of the United States, which are based on registered births and deaths and immigration data, are being made as usual, as soon as the basic figures become available. The United States estimate for July 1, 1936, was tentatively distributed by states, mainly on the basis of the distribution for 1935, and these state estimates were released on October 28, 1936. Estimates for January 1 of the years 1930 to 1936 were issued on January 21, 1937, the State figures being for the most part interpolations from the July 1 estimates. A release giving estimates of the population by age and sex as of April 1, 1935, was given out in February.

CHANGE IN THE WEEKLY HEALTH INDEX

The lack of current or recent population estimates for cities has led to a change in the form and content of the *Weekly Health Index*. The presentation of death rates, which, in the lack of any better basis, has heretofore been based upon the population estimates of 1933, will be discontinued. The *Index* will present the actual number of deaths, including for purposes of comparison the number in the preceding week; also the average number for the corresponding week in the preceding three years; also the accumulated total of deaths up to date in the current year and the corresponding total for the preceding year. Thus the *Index* in its present form is well adapted for showing the trend in individual cities, enabling one to compare deaths in the current week with the 3-year average and to see at a glance by how much the number of deaths since the beginning of the year is running above or below that for the corresponding period of the preceding year. It does not, it is true, permit a comparison of one city with another as regards the death rate. But death rates based on dubious population estimates are, of course, unreliable and often very misleading. In presenting actual numbers only, the *Index* will show facts as they are and will tend to prevent wrong conclusions.

Similar changes have been made in the *Summary of Mortality from Automobile Accidents.* The rates have been discontinued and numbers only are shown.

PHOTOGRAPHING CENSUS RECORDS

The Bureau of the Census has recently installed an elaborate apparatus for photographing census records. It includes two cameras which were specially constructed to photograph the population schedules in bound volumes without removing the sheets from their bindings. The ribbon films used in these cameras, though only 35 millimeters wide, can be easily read by use of magnifying projectors, forty of which have been installed for this purpose. The cameras are just now being used for photographing the population schedules of the census of 1840 which are bound in 273 volumes, giving the names of heads of families with a classification of the population by age, sex, and color. There are two other cameras which are designed for photographing loose sheets.

Other cameras of a standard type, such as used by banks and business houses, have been purchased, and will be first used for photographing the index cards of the census of 1900. They may be used lated for photographing birth and death certificates. The film is only 16 millimeters in width but can be enlarged and read on the same projectors as are used for the wider films.

There are over 20,000 volumes of population schedules, covering every census from 1790 to 1930 inclusive, except the census of 1890 for which the schedules were destroyed or badly damaged by fire. A floor space of 16,000 square feet is required to store these volumes arranged on shelves so as to be readily accessible. As reproduced on films they could all be kept in file cases conveniently accessible in the room occupied by the writer, in which the floor space—20×17 feet—is hardly more than 2 per cent of that required for storing the bound volumes.

In addition to the saving in storage space there are other advantages secured by having the schedules photographed. The original documents will be preserved from the wear and tear of frequent handling; and the existence of duplicate records on safety (non-inflammable) films will be an added precaution against loss by fire or water.

THE CARD INDEX FOR THE 1900 CENSUS

The Bureau of the Census, as announced in a previous issue of the JOURNAL (December, 1935), is making a card index of the population enumerated in the census of 1900. An average of about 2,500 persons, taken from the relief rolls, have been employed in St. Louis on this work since September, 1935. The transcription of the data from the population schedules to the cards is now completed, and the cards are being indexed by the Russell Soundex system. The index is completed for 26 states and the District of Columbia, covering about 30 per cent of the 76,000,000 people living in continental United States in 1900. The cards, one or more for each family, are indexed under the name of the head of the family and give the name, relationship to the head of the family (wife, son, etc.), date of birth (month and year), age in years, and birthplace (state or country), of every member of the family, including boarders and lodgers. The total number of cards is about 32,000,000.

LIFE TABLES

The United States Life Tables for 1930 have now been published in an octavo cloth-bound volume of 57 pages containing 28 tables and three pages of introductory text.[1] It includes three sets of tables based on the population census of 1930 and on deaths for 1929 to 1931. One set covers all continental United States; another is limited to the registration states of 1920; and a third covers the original registration states. The last two sets make it possible to compare the tables for 1900, 1910, and 1920, previously published, with 1930 tables covering the same areas. In order to facilitate such comparisons, six of the tables contained in the volume of Life Tables prepared by Dr. Glover and published by the Bureau of the Census in 1920 have been reproduced in the present volume. Another set of tables covers the period 1920 to 1929 and is based on the censuses of 1920 and 1930. Then there are tables covering the period 1919 to 1921 based on the census of 1920.

J. A. H.

A CORRECTION

In the article by Dr. Hugo Muench on "The Probability Distribution of Protection Test Results," this JOURNAL, 31 (1936), 677–690, change P to p on the seventh line of page 680 and the n's to s's in equation 16, page 685.

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[1] The volume is on sale by the Superintendent of Documents, Washington, at the price of 75 cents.

STATISTICAL NEWS AND NOTES

DOMINION BUREAU OF STATISTICS, CANADA.—*1936 Census of the Prairie Provinces*. To date the Census Branch has published 19 bulletins in connection with the Census of the Prairie Provinces of June 1, 1936. Of these, 13 are on straight population, 3 on employment and unemployment, and 3 on agriculture. The coding for agriculture, housing, families, earnings, occupations, employment and unemployment has reached the half way mark.

As a result of experiments carried out by the mechanical staff of the Bureau, a new tabulator machine has been designed and tested and is now on the point of being put into operation. There is no practicable limit to the possibility of this machine in the number of cross-classifications which may be made. It contains 520 individual counters, 40 banks of adding machines and takes the standard commercial card of 45 columns of information at the rate of 325 per minute. It analyzes three-, four- and five-way combinations of data simultaneously and takes final aggregates of each class.

Census of 1931. Three further volumes of the Census of 1931, namely, Volume V—*Housing, Households, Families and Earnings*, Volume VII—*Occupations*, and Volume VIII—*Agriculture*, are now on press and are expected to be ready for distribution within the next few months.

The Social Analysis Branch. In close conjunction with the census, a Social Analysis Branch has been recently established in the Dominion Bureau of Statistics at Ottawa. Mr. M. C. MacLean, M.A., F.S.S., formerly Chief of the Education Statistics Branch, is Chief of Social Analysis and responsible for the organization and operation of the Branch. The nucleus of the organization is a research staff selected from the successful candidates for census-clerk positions in 1931 and 1936 on the bases of: (1) university record of standing and field of specialization; (2) oral interviews; and (3) short theses to test fitness for research and analysis.

The immediate project in hand is a series of census monographs, but other parallel functions fulfilled by the Branch are: general research into the best methods of selection and rejection of material and the best manner of compilation and presentation of future census data; methods of sampling to obtain reliable periodical figures of unemployment and to overcome bias in the case of incomplete returns; a method of computing an index of segregation for those sections of the population which tend to settle in "blocs" (there are indications that this index is inversely correlated with intermarriage and other manifestations of assimilation); and the best method of measuring the general emigration movement.

Classes on statistical method are held out of office hours and are attended voluntarily by about one hundred clerks.

Manufactures Branch. In an effort to bring the Bureau's classification of industries more in line with the recommendations of the Committee of Statistical Exports of the League of Nations, a revision of the present classification is now being made. The latest previous revision was undertaken in 1928.

Education Branch. A discussion between officials of the Dominion Bureau of Statistics and Provincial Deputy Ministers of Education took place in October, 1936, in connection with the biennial meeting of the Canadian Education Association. An agreement was reached on the uniform presentation of the financial statements of local school authorities and also of teaching personnel. The general improvement of statistics of pupils, and programs of study were subjects of resolutions passed at the meeting. The latest previous conference of this nature was held in 1920.

Mineral, Metallurgical and Chemical Branch. During October, 1936, discussion took place in London between the Dominion Statistician and representatives of the Imperial Institute, London, relative to the unification of mineral and metallurgical statistics of the British Empire. Progress has also been made in unification of the presentation of mineral statistics as between provinces of Canada and the Dominion.

Internal Trade Branch. In recent months the Bureau of Statistics has achieved definite progress in the improvement of the method of estimating "Invisible Items for the Canadian Balance of International Payments." This problem is made especially difficult in the case of Canada on account of the existence of large numbers of branch and subsidiary firms with head offices in other countries and whose long-term and short-term capital movements are complex. The classifications of purchases and sales of securities between Canada and other countries is another matter which has received attention, and ocean freight payments are now based on more comprehensive data, rates being applied to actual tonnages carried in British and foreign vessels.

Central Electric Stations. In a special study on electric power used in Canadian manufacturing and mining industries, the Bureau of Statistics correlated the increase in mechanical power and in man power so used for the period 1923 to 1934. This study has revealed a marked divergence of the power and employee index numbers, particularly subsequent to 1929 but also a more or less steadily increasing difference each year from 1923 to 1929; the power index was 48.3 points above the employee index in 1929 and 19.6 points above in 1934.

External Trade. The Bureau of Statistics has recently experienced difficulty in connection with the treatment of gold in trade statistics. Formerly exports were recorded as merchandise. When the Royal Mint began refining gold in Ottawa and gold began to be exported in the form of bullion, most of the gold production of Canada was recorded in the "Coin and Bullion Section." Latterly, after conferences between the Bank of Canada, the Department of National Revenue and the Bureau of Statistics, a policy has been developed whereby all gold bullion which goes out of the country as merchandise will be entered as such and will be recorded in total commodity exports. In consequence of this arrangement, Canada's exports of total trade have been revised from 1926 to date.

Institutional Statistics. The establishment of the Hollerith card system for the collection and compilation of statistical data of penitentiaries and tuberculosis institutions in Canada by the Institutional Statistics Branch of the Dominion Bureau of Statistics has made available much more detailed information on these subjects. The following publications are due to appear in 1937: (1) Annual Report on Mental Institutions, (2) Annual Report on Hospitals, (3) Annual Report on Penitentiaries, (4) Directory of Hospitals in Canada, (5) Quinquennial Report on Charitable and Benevolent Institutions, and (6) Quinquennial Report on Reformative and Corrective Institutions.

Finance Statistics Branch. The annual meeting of the Municipal Finance Officers Association of the United States and Canada was held in Toronto, Ontario, on September 9, 10 and 11, last. The Association is comprised of finance and accounting officers of state and local governments. Financial statisticians from the Bureau of the Census, at Washington, and the Dominion Bureau of Statistics, at Ottawa, attended the Conference on the invitation of the Executive Committee. The following resolution was adopted:

> RESOLVED That this Association recommend to the Bureau of Statistics of the Dominion Government, Ottawa, the calling together of a conference of representative Municipal Finance Officers from the different Provinces. The main purpose of such conference to be for the supplying of information in greater detail and with more uniformity for the citizens and officials of the Local and Provincial Governments and all other interests needing reliable and comparative municipal statistics.

A bulletin on the "Public Debt of Canada" has just been issued by the Finance Branch. The report gives a brief analysis of the debt of the Dominion Government and each of the Provincial Governments for the year 1935 and the total debt of all municipalities by provinces, at the close of 1934.

CENTRAL STATISTICAL BOARD.—The Central Statistical Committee and the Central Statistical Board have issued, under the powers conferred by its organic Act, the first of a series of regulations drafted to put on a formal and more effective basis the specification of schedules, questionnaires, and other materials relating to plans for statistical inquiries which should be reviewed by the Central Statistical Board. Although the Board is empowered under its Act to require the submission of material to it for review, it acts only in an advisory capacity in regard to the content of the material so submitted. Regulation No. 1, which has been circulated to the various agencies of the Federal Government, is as follows:

SUBMITTAL BY FEDERAL AGENCIES OF QUESTIONNAIRES AND OTHER MATERIAL TO THE CENTRAL STATISTICAL BOARD FOR REVIEW

PROMULGATED NOVEMBER 11, 1936

WHEREAS, it is necessary that the Central Statistical Board, established by Public, No. 219, Seventy-fourth Congress, approved July 25, 1935 (49 Stat. 498), be informed of plans for statistical inquiries in advance of the sending out of questionnaires, in order that unnecessary duplication and multiplication of questionnaires addressed to the same persons may be avoided, and in order that the Central Statistical Board and other interested agencies may be afforded an opportunity to offer suggestions regarding any proposed inquiry with a view to making the information collected more widely useful:

THEREFORE, pursuant to the authority vested in the Central Statistical Committee by section 5 (c) of Public, No. 219, Seventy-fourth Congress, hereinbefore cited, the Central Statistical Committee hereby prescribes that—

Definitions

1. (*a*) The term "questionnaire" as hereinafter used shall mean any form employed or to be employed by any agency of, or subject to the supervision of, the Federal Government, when such form incorporates a question or questions to be asked of several or many respondents or when such form provides for the original recording of answers to such question or questions.

(*b*) The term "general questionnaire" shall mean a questionnaire to be sent to 20 or more respondents, providing that (i) the respondents, in answering the said question or questions are not acting as employees or agents of the Federal Government, and provided that (ii) it is expected to make combined totals or averages from information obtained from the use of the said questionnaire.

(*c*) The term "restricted questionnaire" shall mean any questionnaire other than those specified under (*b*) above.

General Questionnaires

2. (*a*) Except in such cases as the Chairman of the Central Statistical Board or his duly authorized agent from time to time may specify in writing on his own motion or at the request of the interested agency, every proposed general questionnaire shall be submitted to the Central Statistical Board for review prior to adoption, and such submittal shall be early enough to allow the Board at least two working days for such review.

(*b*) In the case of a general questionnaire which is to be printed or otherwise multicopied, the term "adoption" shall mean the sending of copy to any office for duplication in a form to be disseminated to enumerators or respondents. In the case of a typewritten or other manuscript questionnaire, the term "adoption" shall mean submittal to the responsible officer of an agency for his approval of it for dissemination to enumerators or respondents.

(*c*) Any general questionnaire which is now in use or which shall hereafter be adopted and which shall continue in use currently without change for more than six months after adoption, shall, upon request of the Chairman of the Central Statistical Board or his duly authorized agent, be submitted or resubmitted to the Board for review.

Restricted Questionnaires

3. If the Chairman of the Central Statistical Board or his duly authorized agent shall make inquiry respecting any restricted questionnaire, and shall find that said questionnaire provides or might provide statistical information of general interest, said questionnaire shall on his written request be submitted to the Central Statistical Board for review.

Memorandum of Information

4. Each questionnaire submitted for review in accordance with paragraphs 2 or 3 shall be accompanied by a memorandum of information which shall set forth the purposes of such questionnaire, the methods and administrative ar-

rangements proposed for its use, the type or types and approximate number of the respondents, and any other information deemed by the submitting agency to be pertinent, and no questionnaire shall be deemed to have been submitted in accordance with this regulation unless accompanied by such memorandum.

Other Forms or Materials

5. Each agency submitting a questionnaire to the Central Statistical Board for review in accordance with the provisions of paragraphs 2 or 3, shall submit to the Central Statistical Board for review such forms, statements of instruction and other materials pertaining to the collection, tabulation, analysis, or publication of the data from said questionnaire as the Chairman of the Central Statistical Board or his duly authorized agent shall specifically request in writing.

Other Information

6. Each agency of, or subject to the supervision of, the Federal Government, shall, upon the request of the Chairman of the Central Statistical Board or his duly authorized agent, furnish any information in its possession which the said Chairman or his duly authorized agent may deem necessary to assist in the review of any questionnaire, form, statement of instruction, or other material submitted by such agency or by any other agency to the Board for review. No review of a questionnaire, form, statement of instruction or other material shall be deemed completed until after the submitting agency shall have furnished the information requested of it in accordance with this paragraph.

State and Local Public Finance News Letter. A second issue of the *News Letter* of the Board's Committee on State and Local Public Finance was released in January. This issue, in addition to presenting news items regarding state and local government finance and activities, outlines six possible major improvements that the executive subcommittee feels are needed in available data on activities of state and local governments. A limited number of copies of the second issue of the *News Letter* may be had without charge upon request to the Executive Secretary of the Central Statistical Board, Mr. Morris A. Copeland, 7028 Commerce Building, Washingtion, D. C.

Municipal Reference Library and Information Service. A Municipal Reference Library and Information Service is now in process of being established in the Federal Government. The library will be located in the Bureau of the Census, which will make the library facilities available to public officials and others and will act as an information bureau serving Federal, state, and local agencies. Among the new acquisitions to the library are selected current municipal documents which are being secured through the agency of the WPA Federal Writers' Project, from the 191 cities having over 50,000 population. The Bureau of the Census will catalog the documents and keep the library up to date with systematic additions. Federal agencies that have maintained temporary collections of municipal documents have suggested the possibility of transferring portions of their collections to the new library after it has been well established.

New Basis for Reporting Import Statistics. The Division of Foreign Trade Statistics of the Bureau of Foreign and Domestic Commerce has made a cooperative agreement with the Department of the Treasury for reporting import statistics on a new basis. Prior to January 1, 1937, imports were shown from country of final invoice rather than from country of original production. Under the new arrangement, the import statistics will present the data by country of original production. For a time, while the new basis is being established, statistics will be presented both on the old and new bases for purposes of comparison.

BUREAU OF AGRICULTURAL ECONOMICS.—The Bureau of Agricultural Economics has inaugurated a new series of periodical commodity "situation" reports, designed to bring the respective annual outlook reports up to date. They contain a review of developments with respect to supply, demand and prices since the last previous report, and a revised statement of the outlook in the light of these developments. Important current statistics relating to the commodities also are included. The following tentative list indicates the commodities to be covered by the service. The figure in parenthesis following each title is the approximate date of publication, which may be varied to meet conditions as they arise. Unless otherwise noted, the reports are monthly.

1. Poultry and Egg Situation (8)
2. Wool Situation (9)
3. Fats and Oils Situation (10)
4. Sugar Situation (February 14; June 14; December 14)
5. Dairy Situation (16)
6. Demand and Price Situation for Farm Products (17)
7. Hog Situation (18)
8. Beef Cattle Situation (19)
9. Sheep and Lamb Situation (20)
10. Fruit and Vegetable Situation (21)
11. Wheat Situation—including rye (23)
12. Feed Crops Situation (March 25; August 25; December 25)
13. Cotton Situation (25)
14. Tobacco Situation (January 26; March 26; July 26; September 26)

There has been unusual interest in a report, recently issued by the Bureau of Agricultural Economics in cooperation with the New Jersey College of Agriculture and the Pennsylvania State College, on the organization, facilities and practices of the Philadelphia wholesale and jobbing markets for fresh fruits and vegetables. This report is an analysis of the present situation in these markets. In it the chief weaknesses on the markets are pointed out and suggestions are made for increasing marketing efficiency through reorganization and improvements in facilities and practices.

In reaching these conclusions a large volume of statistical material was collected. For an entire year records were made of receipts of fruits and vegetables by rail, truck, and boat at each of the four principal wholesale and jobbing markets and the chain store warehouses. For two sample periods of two weeks each (one in the winter season and the other in summer) sales records were obtained from a representative number of dealers on each market in order to find out the area served by each market. This information showed in addition to the total volume of business transacted in each market throughout the year, the volume of such business received by rail, truck, and boat, the amount of cross-hauling among markets, the proportion of sales of each market going to chain stores, independent retailers in Philadelphia, and out-of-town buyers, and the extent to which the territory surrounding Philadelphia is dependent upon Philadelphia markets for its supplies of fruits and vegetables.

Nearly two hundred buyers in this area supplied by the Philadelphia markets were interviewed to find out the extent to which they are dependent upon the Philadelphia markets, and shift toward or away from Philadelphia in volume of business, their buying habits, time required for buying, suggestions for market improvement, etc. About the same number of growers in Pennsylvania and New Jersey were interviewed to find out their methods of selling, grading practices, markets used, comments on conditions in the Philadelphia markets together with suggestions for improvement. Similar contacts were made with retailers in Philadelphia as well as with wholesalers and jobbers actually selling in the markets of Philadelphia.

In studying the traffic problem in the markets where truck receipts are heavy and congestion is sometimes great, records were kept for several days of all trucks (separated into three groups: growers, buyers, and miscellaneous) arriving at the Dock and Callowhill Street markets between 6 P.M. and 9 A.M. together with the number of trucks in each classification standing in the markets each hour and a description of the traffic situation in every part of the market each hour. Actual time records were kept on approximately 75 growers' trucks and an equal number of buyers' trucks to note exactly how long they were in the markets and how the time was used.

After all the above data and much more additional information on general conditions and practices in the markets had been collected, an opportunity was given for all individuals or groups interested in the markets to express their views. Finally, after all the statistical material had been summarized and the opinions and suggestions recorded, the agencies making the study met for several days discussing the problems and drawing their conclusions. A committee representing car-lot receivers in Philadelphia has been appointed to study the report and to recommend to the trade such action as they think proper. Several meetings of farmers have been arranged in New Jersey and Pennsylvania to discuss the report.

At present the Bureau is collecting general information on the markets of 39 other cities.

The Division of Agricultural Finance is engaged in analyzing data for wheat, cotton, and corn, collected in connection with the Agricultural Adjustment Administration, to determine whether they might provide an actuarial basis for crop insurance. The analysis of data pertaining to wheat, while not completed to date, provides the statistical basis for the recently published *Report of the President's Committee on Crop Insurance.*

Costs of indemnifying wheat losses have been determined in 210 counties. Data on identical individual farms cover the 6-year period 1930–35 inclusive. The study indicated that in certain areas there appears to be little relationship between the amount of insurance and the average annual indemnities required per acre, while in other areas it appears that the average annual cost of indemnifying losses is larger for those farms with the larger insurance coverage and smaller for those farms with the smaller insurance coverage. In other areas it is apparent that farms with higher coverage would require a smaller average annual indemnity per acre.

In order that excessive insurance would not be provided for the farm that has low average yields and that too limited coverage would not be provided for the farm that has high yields, it was decided that the amount of insurance on any farm would be some specified percentage of the average yield on that farm. The premium rate would be determined on the basis of two factors—the loss experience on the individual farm insured and the loss experience of the county or area, each factor being given equal weight. For the purpose of the study, the average annual indemnity per county was determined by getting the average indemnity for 75 farms for each year, weighting each indemnity by the wheat acreage planted on the farm. Finally the county average per acre indemnity for all 6 years was averaged without weighting. Acreage weights were not used in combining the 6 years because to do that would assume that in future years the same combination of high or low indemnities with large or small acreage would be repeated as occurred in the years 1930–35.

The Bureau of Agricultural Economics recently issued four reports in the machinery series for the Northern Great Plains and Pacific Northwest region. The purpose of the report on the "Cost of Operating Farm Motor Trucks on Grain Farms" is to show the extent to which farm motor trucks are used and what present owners, as well as prospective purchasers of motor trucks, can reasonably expect in the way of cost of using motor trucks on relatively large grain farms. The other publications in the series are:

1. Utilization of tractors and cost of tractor power on grain farms.
2. Utilization of combined harvester-threshers and cost of harvesting small grains with a combine.
3. Tillage, planting, and harvesting equipment on grain farms and rates of doing field work with these implements when drawn with horses and with tractor power.

Other recent publications of the Bureau are: *Cost of Production of Beets, Carrots, Cauliflower and Other Vegetables* which presents tables under each commodity showing cost data, acreage, and production or value of the crop by States; *Cost of Production of Tomatoes* which presents data from studies in 20 states for selected years, 1913–34; and *Cost of Production of Citrus*

Fruits which presents data pertaining to production by states, number of citrus trees in Arizona, Florida, and Texas, and cost data for California and Florida.

A monthly publication entitled *Foreign Agriculture* has been inaugurated by the Foreign Agricultural Service of the Bureau of Agricultural Economics. The first edition was issued dated January, 1937. *Foreign Agriculture* will include primarily articles which formerly appeared as feature stories in *Foreign Crops and Markets*. The field that will be covered by these articles will, in general, fall within three broad classifications: (1) foreign government policies relating to agriculture, (2) foreign agricultural production, and (3) international trade in agricultural products.

AGRICULTURAL ADJUSTMENT ADMINISTRATION.—A considerable volume of useful data is being compiled by the Agricultural Adjustment Administration in connection with the administration of agricultural conservation programs under the Soil Conservation and Domestic Allotment Act.

All farmers who expected to participate in the conservation program for 1936 were required to fill out a worksheet which showed the acreages of farm land and crop land, and estimated acreages in each of the several principal crops in 1935 for each farming unit. Altogether, well over 4,000,000 worksheets were submitted, and a worksheet was obtained for every farming unit in the ten states in the North Central Division—Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin.

In checking performance, the acreages in each base and in each of the several principal crops were either measured or estimated on every farm which applied for a grant under the program, so that even more accurate data have been obtained for 1936 than for 1935. Although every farm is not covered, the number of farmers cooperating in the program was large enough so that the ratios and relatives derived from these data should be of value in describing conditions or farm organizations actually existing in each state or region. In addition, a comparison of these performance data for 1936 with the worksheet data for 1935, or a comparison of the performance data which will be obtained for 1937 with those for 1936, should give a very accurate measure of changes in acreages on farms being worked by farmers cooperating with the Agricultural Adjustment Administration.

FEDERAL TRADE COMMISSION.—During November and December, 1936, and January, 1937, the Commission issued a series of reports on the textile industry for the last half of 1935: Part I dealing with cotton textiles, Part II woolen and worsted textiles, and Part III silk and rayon textiles.

These reports analyze the operating and financial data of the textile companies reporting to the Commission. For example, Part II shows labor costs, profits and investments of 258 woolen and worsted companies, the results for the last half of 1935 being compared with prior half-year periods back to January 1, 1933. A detailed analysis of operations per pound or square yard of production is shown for those companies which manufacture only one of several general types of goods and which were able to supply quantity figures.

In addition to the above-mentioned series, a report on the cotton textile industry for the first half of 1936 has just been issued by the Commission. The report covers 580 cotton textile companies operating spindles of about 64 per cent of the total in place in the United States and looms of about 64½ per cent of the total in place, and presents statistical data similar in general character to those of the reports referred to above.

These textile reports, which follow the issue of several others in recent years, conclude the investigation conducted by the Commission pursuant to an Executive Order of September 26, 1934, and supplemental authorizations, the stated purpose of which was to show what effect increased wages and shorter hours might have on the textile industries.

The Commission's final report on the milk industry pursuant to a Congressional Resolution was made to Congress in January, 1937. This report based upon an investigation conducted in four important milk sheds and a study of the market regulations and the practices of distributors in four large cities, contains the Commission's conclusions and recommendations. An important recommendation is one with regard to the negotiation of State compacts relating to the production, sale, and distribution of milk and milk products, which concern the interests of two or more states but which do not exclusively involve interstate commerce.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.—Several annual publications of statistical importance were made available during the first quarter of 1937 by the Bureau of Foreign and Domestic Commerce. Principally among these are the *Foreign Commerce Yearbook, 1936*, and *The Statistical Abstract of the United States, 1936*. Both of these publications were described in greater detail in the December issue of this JOURNAL.

A 1936 supplement to the *Survey of Current Business* was also released. This is the first time it has been possible to issue this supplement since 1932. The present volume makes corrections for interim changes and presents the statistical record by months for the years 1932 to 1935 inclusive, together with monthly averages, or annual indexes, back to 1913 where available. This volume is available at a cost of 35 cents from either the Government Printing Office or from the District Offices of the Bureau of Foreign and Domestic Commerce.

The Division of Economic Research has recently published a study, *Long Term Debts in the United States*. The principal topics covered are (1) changes in the volume of long-term indebtedness by principal classes of borrowers from 1912 to 1934; (2) changes in the annual interest charges on the several classes of long-term debt during this period; (3) the volume of obligations in default on different dates; (4) the comparative ages of the several classes of debt outstanding in 1933; and (5) the ownership of the evidences of debt as of a recent date. A special effort was made to compile and analyze the information that will shed light on the adjustments that have taken place in the long-term debt structure during the depression years.

Recent publications of the Marketing Research Division include one on *Markets for Plumbing and Heating Facilities in Residences.* This volume, based upon information gathered in connection with the *Real Property Inventory* and which shows the unfilled market for the facilities analyzed, was made available late in January. The February 20th and 30th issues of *Domestic Commerce* carried the Bureau's estimates of wholesale and retail trade during 1936. A booklet on the lumber industry, presenting sources of detailed information, the names of Government agencies most closely allied to the industry, and a list, with addresses, of national and interstate trade associations, was released early in February.

The Market Data Section has under way at the present time, its annual study of retail credit conditions. Schedules have been mailed to cooperators asking for 1935 and 1936 data and indications are that the sample will be larger and more representative than in past years. Plans are also being formulated to revise *Market Research Sources* to appear early in 1938. All readers of the JOURNAL who have made or are making studies in the field of marketing should notify the Marketing Research Division, Bureau of Foreign and Domestic Commerce, of such studies for inclusion in this volume. The Bureau would appreciate any suggestions by JOURNAL readers of what new materials should be included.

A series of maps showing world production, consumption and principal trade movements of 33 various minerals in 1932, have been jointly prepared by the Bureau of Foreign and Domestic Commerce and the Bureau of Mines. These maps, which appeared in *Domestic Commerce,* have been reprinted and are available to readers of the JOURNAL.

Among the publications issued by the various commodity divisions of the Bureau is a series of processed booklets by the Foodstuffs Division which analyzes imports and exports in foods by commodity groups. The Automotive-Aeronautics Division issued, during January, two descriptive lists, one the *Highways of the World* and the other *Airlines of the World,* the latter of which is a comprehensive study of the principal companies, their addresses, routes from and frequency of mileage of flights. A map showing world airways is also included.

The Leather and Rubber Division, as a supplement to its *Leather Raw Materials* bulletin, has been publishing a series of articles under the general title, "International Trade in Goatskins." Articles published to date cover Trade of the United States, United Kingdom and Germany. These are to be followed by one on France, as well as a series covering the sources of this commodity. This same division expects to release during March a mimeographed survey of United States consumption and year end stocks of crude and reclaimed rubber.

The Division of Negro Affairs expects to make available shortly the results of its study which analyzed the contributing causes to failures among negro insurance companies.

The Tung Oil Blue Book has been issued by the Chemical Division of the Bureau. This volume presents the history, progress, and statistics of American production, the United States consumption and the world market situation relative to other drying oils.

The Specialties Division has recently published a bulletin on the *World Production and Trade in Sponges*, and a mimeographed release on the *Japanese Pottery Industries*. Both of these studies contain many statistical series. The pottery bulletin covers production, export and import trade, wages and hours of labor in the Japanese pottery industry and other factors of economic import.

U. S. BUREAU OF MINES.—Since 1909 a series of annual statistical surveys covering available supplies of secondary copper, lead, zinc, and other nonferrous metals has been published by the Federal Government—in the early years by the U. S. Geological Survey and since 1925 by the U. S. Bureau of Mines. Over nearly 30 years the figures on nonferrous secondary supplies have been constantly improved and now represent an important consideration in any study of the markets for these metals. No similar series of annual data has ever been developed for the important ferrous scrap. To fill this gap the Bureau of Mines hopes to maintain such a series, and the results of the first survey were released in December, 1936 (*Consumption of Ferrous Scrap and Pig Iron in the United States, 1935*, U. S. Bureau of Mines, Report Investigations, 3329, Mineral Economic Series 1); copies of this survey can be obtained by writing the Director, Bureau of Mines, Washington, D. C.

Following the suggestions of the Central Statistical Board, the Bureau of Mines and the Bureau of the Census collaborated in the conduct of a census of mines and quarries for 1935. The Bureau of Mines undertook the responsibility for the direction and guidance of the survey and additional staff were provided from the Census of Business. The usual questions of both Federal agencies were consolidated on a single schedule, and approximated as closely as practicable the most important items in the decennial census. These surveys are now being completed and some of the industry reports will be released in the early months of 1937.

In cooperation with the National Research Project of the Works Progress Administration the Bureau of Mines is conducting a survey of technological advances, productivity and employment in the mining industry for the period 1880 to the present.

DIVISION OF RESEARCH AND STATISTICS, BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM.—The Division of Research and Statistics of the Board of Governors of the Federal Reserve System is conducting a study of the turnover of various classes of deposits of weekly reporting member banks in 101 leading cities. The Division is also developing a method, which can be applied currently, of estimating adjusted demand deposits and time deposits for all nonmember banks in the United States on selected call report dates beginning in 1928. It is intended later to extend the series over earlier years.

DIVISION OF RESEARCH AND STATISTICS, U. S. TREASURY DEPARTMENT.—*Collections from Selected State-Imposed Taxes, 1930–36.* In connection with its studies of the types of taxes imposed by both the Federal and State governments, the Division of Research and Statistics of the United States Treasury Department prepared a compilation of collections from the following State-imposed taxes: Estate and inheritance, individual income, corporation income, gasoline, motor vehicle registrations and licenses, general sales, liquor, and tobacco. The report was released on November 30, 1936, as a publication of the Treasury Department. It presents State-by-State and summary data both on total collections and on the sharing of the revenue between the States and their political subdivisions. The data were obtained from officials of the various States and from published reports of State authorities.

Capital Movements. On November 27, 1936, the United States Treasury Department released a publication entitled "Statistics of Capital Movements between the United States and Foreign Countries and of Purchases and Sales of Foreign Exchange in the United States." The statistics presented in this publication cover the period from January 2, 1935, to September 30, 1936, and are arranged to show data both by weeks and by principal nations or geographical areas. The component elements of international capital and exchange transactions are set forth in some detail. There is also a group of Summary Tables, and graphic presentation of part of the summary data. The report was prepared in the Division of Research and Statistics on the basis of data reported weekly to the Treasury Department, pursuant to the Executive Order of January 15, 1934, and the Treasury Regulation of November 12, 1934. It is the intention of the Treasury to continue the publication of these statistics at quarterly intervals.

DIVISION OF ECONOMICS AND STATISTICS, FEDERAL HOUSING ADMINISTRATION.—A report embodying a series of estimates on housing construction during the years 1920–1936, with a forecast for 1937, has been completed. The study estimates the number and value of non-farm dwelling units built annually, 1920–1936, with breakdowns by the types of structures for the years 1926–1936. Over the 16-year period, the estimates indicate the total of non-farm units built annually throughout the country rising in a steep curve from the 1920 figure of 203,500 to the 1925 crest of 933,500, after which it tapers off gradually until the middle of 1928, when an abruptly declining curve sets in, extending almost unbroken to the low point of 53,100 in 1934, and rising again to the 1936 total of 270,500.

For the year 1937, it is estimated that between 400,000 and 450,000 non-farm dwelling units will be built. This figure is somewhat less than the 1929 estimated production of 500,000 units, and is equal to, or slightly greater than, the 1921 estimate of 400,000 units. The 1937 forecast is more likely to err as an under-statement rather than as an over-statement. It has been qualified by a number of interesting details on the principal factors, which, it is believed, will affect home building activity during the year 1937.

The statistical method used in compiling the study was as follows: The Censuses of 1920–1930 were used to obtain the total increase in dwelling units. After adjustments were made for changes in vacancy, for conversions, demolitions, fire, and other losses, the total volume of construction for the decade thus obtained was distributed on an annual basis. This was accomplished through use of the building permit data for 257 identical cities, and by assuming that these data presented a reasonably accurate measure of the fluctuations in building activity throughout the country for the decade 1920–1930.

To obtain the annual estimates of urban non-farm dwelling units constructed during the years 1931–1936, the ratio of number of new family units to the total number of families in various city-sized groups were utilized. These ratios were based on the Bureau of Labor Statistics building permit data for 257 cities for 1930–1932, for approximately 750 cities for 1933–1935, and for approximately 1,500 cities for 1936. To this figure there was added the rural non-farm estimate, derived by assuming that home building in these areas constituted 20 per cent of the total in all non-farm areas. Summaries of the study have been published. Valuable assistance was rendered in preparing these estimates by George Terborgh, of the Board of Governors of the Federal Reserve System, and by David L. Wickens and Raymond R. Foster of the National Bureau of Economic Research, each of whom presented estimates of construction activities at the annual meeting of the American Statistical Association and the American Economic Association held recently in Chicago.

The *Third Annual Report of the Federal Housing Administration* is now available for distribution. Included in this report is a 35-page statistical analysis of the insuring operations of the Administration. This analysis gives detailed consideration to the activities of the Modernization Credit, Mutual Mortgage Insurance, and Large Scale Housing Divisions, indicating the volume of business transactions; characteristics of the loans, of the property (number of rooms, type of structure, etc.), and of the borrower.

A technique for analyzing mortgage experience data has been prepared and published by the Division. The case study method is utilized and the tabulations it makes possible will reveal such significant lending factors as the relationships of delinquency and of foreclosure to the age and size of the mortgages, year in which the loan was made, type of property, method of repayment, the ratio of the loan to the appraised value, and other significant factors. An analysis of the connection between delinquencies and foreclosures will show the extent to which delinquency leads to foreclosure, and will identify critical periods with regard to delinquency. It is believed that an analytical treatment of this nature covering a large number of mortgages over an extended period of time will result in the establishment of more concise lending principles.

Ernest M. Fisher and Richard U. Ratcliff have completed a report entitled "European Housing Policy and Practice," which gives a brief summary of general principles and conclusions evolved from a survey of housing in 10 foreign countries. Much of the material is supplemented by statistical data. Copies of the pamphlet are available for public distribution.

Three monographs giving the loan value ratio, the amortization factor, and the borrower's total monthly financial charges on Federal Housing Administration mortgages have been prepared. They enable the various ratios to be secured quickly and without mathematical calculations. All three are available for public distribution.

The Division is carrying forward a study of city growth and structure in an effort to obtain a better understanding of neighborhood changes affecting mortgage risk. The study is based principally upon a series of maps prepared by the Division which present vital real estate facts by blocks for more than 100 cities including 150,000 blocks, and an analysis of the growth of 15 American cities. Arrangements for the publication of the entire study are as yet incomplete, but five special articles based on studies of Washington, Chicago, New York, Detroit, and Miami, together with a summary, are appearing currently in the *Insured Mortgage Portfolio*, a Federal Housing Administration monthly publication.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR.—Senate Resolution 298, of the last Congress, directed the Secretary of Labor to report on "the social and economic needs of laborers migrating across State lines." At the Secretary's request, the direction of the investigation was undertaken by the Bureau of Labor Statistics, with the cooperation of the Children's Bureau, the Employment Service, and certain other agencies.

Work on the survey of wages and hours in the bituminous-coal mining industry is well advanced, and it is anticipated that the field survey will have been completed by May 1. This study covers 98 per cent of the territory where bituminous coal is produced. It is conducted however on the basis of a sample, which will include about 90,000 employees or 20 per cent of the total number of workers in the industry. In addition to data on weekly wages and hours of employment, annual earnings are being obtained, and information on time spent going to and from the working place and at lunch. Also, in conformity with the Bureau's present policy, a personnel study is included. Attention is being directed to housing, living conditions, and welfare work as well as to plant personnel methods. Definite plans are being made for wage surveys covering the cotton, rayon, and silk goods industries, and if resources permit, a study of working conditions in the hosiery industry will be made.

The Accident Division is now concentrating its efforts on increasing the coverage of its reports from 7,000 to 25,000–30,000 establishments by an enlarged sample from the 13 industries already reporting, and by the inclusion of 20 additional industries. Cooperative arrangements have been made with trade associations in the fertilizer and construction industries, whereby special surveys will be made of the causes of accidents in those industries.

UNITED STATES EMPLOYMENT SERVICE.—*Occupational Analysis of Active Registrants Completed.* An occupational analysis of over 6½ million persons seeking work through offices of the United States Employment Service was conducted at the close of December. The analysis was designed to indicate the distribution of workers according to their occupational skills and to indicate the number of persons with relief status in the various occupations. For the first time, information concerning the secondary occupational classifications of applicants as well as the occupations in which they were primarily classified was secured.

This occupational survey provides information directly comparable to the occupational classifications secured at the time the more complete inventories of the active file were conducted on July 1, 1936, and during December, 1935.

The present analysis, which covers only occupational information and does not include the full industrial, age, and other classifications prepared in connection with the earlier inventories, established a new record for speed. Preliminary tabulations covering 98.6 per cent of all active job seekers registered with the offices throughout the country were available in less than four weeks after the field work was conducted in the offices.

NEW YORK STATE DEPARTMENT OF LABOR.—The Department will issue soon a study entitled *Trend of Manufactures in New York State from 1919 to 1933* based upon the biennial reports of the U. S. Census of Manufactures. The study brings out the relative position of manufacturing in New York State for the period covered as compared with manufacturing in the United States as a whole. Use is made of the five significant figures revealed by the census, namely number of factories, number of employees, total wage bill, value of products, and value added by manufacture. It is a factual study designed to throw light upon statements made in recent years alleging a "migration" of industry or "exodus" of factories from New York State.

DIVISION OF SOCIAL RESEARCH, WORKS PROGRESS ADMINISTRATION.—Work is in progress on a series of studies of turnover of workers employed on W.P.A. projects. These studies will provide monthly data on the numbers of workers leaving the W.P.A. to accept private employment or for other reasons, the number of workers returning to the W.P.A. because of loss of private employment or for other reasons, and the characteristics of the workers in each category. The studies are to be conducted by small local staffs in nearly 50 urban and rural areas. Interviews with workers provide information on reasons for leaving or for returning to the W.P.A., on the types of private employment secured and the earnings derived therefrom, and the total incomes of families of separated workers.

During November, surveys of labor shortages were made in Rochester, New York; Cleveland, Ohio; and Milwaukee, Wisconsin. The extent and character of the shortages were determined by interviews with employers trade union officials, W.P.A. and relief authorities, and through the cooperation of public employment offices. In each city, data on the characteristics of workers currently employed on projects were transcribed from W.P.A. labor division records and United States Employment Service registration cards. These data were subsequently analyzed to discover to what extent the characteristics of workers, who reported as their usual occupation one of the shortage occupations, were such as to make them acceptable for employment in private jobs. Acceptability was determined with reference to age, physical condition, length and recency of work experience. The findings of the three studies show that definite shortages existed in a number of occupations, especially in skilled manufacturing and building trades, but that there were relatively few workers employed on W.P.A. projects who were able to meet current requirements of employers in the shortage occupations. Another series of surveys of this type is now under way in agricultural as well as urban areas where shortages are reported.

A study of the geographic mobility of labor in Michigan during the period April 1930–December 1934 is now being carried on in cooperation with the Michigan E.R.A. The data were obtained from the Michigan Unemployment Census of January 1935. Tabulation plans were devised to bring out the significant factors thought to bear on workers' mobility, such as personal characteristics, relief status, and employment record. The tables permit the examination of these data with respect to such aspects of mobility as the number, approximate geographic range, and urban-rural character of moves. From the original 520,000 schedules, a 5 per cent sample was tabulated to test the efficacy of the plans. After preliminary analysis of the data thus obtained, final tabulations will be run in Detroit.

The experimental work has been completed on combining the estimated monthly expenditures for public and private assistance in urban areas, as published by the Social Security Board, and the comparable rural series, as published by the Division of Social Research, W.P.A.

The application of sampling procedures to the selection of a group of cities that would be representative of total urban United States has been the subject of a series of experiments. Using census data for all cities of 10,000 or more population, it was found that a sample of 25 cities could be selected, by regions and by size-group, with social and economic characteristics that differed but little from similar characteristics for all cities combined. Field tests based upon these samples are planned.

The following is a list of recent publications of this Division: Research Monograph V—Landlord and Tenant on the Cotton Plantation; The 1935 Relief Population in 13 Cities: A Cross-Section—Research Bulletin, Series I, No. 23; Legislative Trends in Public Relief and Assistance—Research Bulletin, Series III, No. 2; Survey of Cases Certified for Works Program Employment in 13 Cities—Research Bulletin, Series IV, No. 2; Survey of Workers Separated from W.P.A. Employment in Eight Areas During the Second Quarter of 1936—Research Bulletin, Series IV, No. 3; Workers on Relief in the United States in March 1935, A Census of Usual Occupations—Preliminary Edition; Usual Occupations of Workers Eligible for Works Program Employment on January 15, 1936—Preliminary Edition; Current Statistics of Relief in Rural and Town Areas, January–June 1936, June–July 1936, July–August 1936, August–September 1936, September–October 1936, October–November 1936; Combined Farming-Industrial Employment in the Coal and Iron Subregion of Alabama—Research Bulletin, J-4; Combined Farming-Industrial Employment in the Naval Stores Subregion of Georgia and Alabama—Research Bulletin, J-5; and Combined Farming-Industrial Employment in the Lumber Subregion of Alabama, Georgia, and South Carolina—Research Bulletin, J-6.

DIVISION OF RESEARCH, STATISTICS AND RECORDS, WORKS PROGRESS ADMINISTRATION.—*Works Program Statistics.* Effort has been directed toward the perfection and completion of a statistical series on Works Program employment which will be as nearly comparable as possible with the monthly series compiled under the program of the Federal Emergency Relief Administration. This series provides a count of the number of different persons who worked on W.P.A. and other Works Program projects during each calendar month together with their hours of work and earnings. The series on W.P.A. employment from the beginning of the program through the year 1936 will be published shortly. Subsequently, similar data for other Works Program agencies will be made available.

Relief Statistics. Preliminary general relief data for urban areas have been issued for the period through December 1936 and monthly bulletins presenting information for the Continental United States through October 1936 have been published. These publications were prepared under the direction of Mr. Thomas B. Rhodes, Secretary of the Advisory Committee on the Collection of General Relief Statistics which functions through the cooperation of the Social Security Board. Copies of these publications may be obtained from the Works Progress Administration.

A "Statistical Summary of Emergency Relief Activities, January 1933 through December 1935" was published recently. This bulletin contains 44 pages of revised monthly data and a brief technical description of the series.

The *Monthly Reports of the Federal Emergency Relief Administration* through June 1936 have been issued. A section of the June report is devoted to a discussion of the estimated number of families and single persons receiving relief and persons from relief rolls employed on Works Program and Civil Works Program projects. Monthly estimates of the number of families and single persons and of total persons for the Continental United States are presented for the period January 1933 through August 1936.

Construction Statistics Analysis. A research unit has been established in the Division to analyze the volume of employment and expenditures on construction activities in the United States including both public and private work. The estimates developed cover a long period of time and are intended primarily to assist in program planning.

NATIONAL RESEARCH PROJECT, WORKS PROGRESS ADMINISTRATION.—Notes appearing in previous issues of the JOURNAL have outlined the scope of the several studies undertaken by this Project. As of February 1 the work of gathering materials has for the most part been finished and efforts are being concentrated on the tabulation and analysis of the data assembled. Report plans are now taking shape.

Statistical Studies of Changing Productivity. These studies were undertaken for the purpose of organizing historical data on trends in productivity in American industry as a whole and in its individual components.

Published statistical sources relating to production and employment changes in the major manufacturing and non-manufacturing industries have been examined and productivity indexes constructed for more than thirty separate industries. These data will be combined for an analysis of productivity changes in producers' and consumers' goods industries. Such related series as prices, labor and raw material costs, profits, and capital structure are now being assembled.

In addition, studies are being carried on to measure growth of labor supply, changes in employment and unemployment, and occupational and industrial shifts within the labor supply.

Special Studies of Selected Industries. These studies are chiefly concerned with the relationship of mechanical and managerial changes to the volume of production and of employment in the several industries selected for inquiry.

About 700 manufacturing plants representing various industries have been visited to obtain time series on production and employment. In selected industries the surveys are designed to cover collateral economic factors, including the effects of changes in the ratio of output to production capacity, capital devoted to production processes, equipment, wages, prices and competition. The following industries are being studied jointly with the National Bureau of Economic Research: brick and tile, lumber, cement, beet sugar, and flour milling. A survey of machinery and equipment manufacturers is providing data on labor embodied in the equipment used in the production processes of the industries enumerated above and on types and rates of mechanization. The U. S. Bureau of Labor Statistics is cooperating on field surveys and other industries—boots and shoes, leather, silk, cotton and rayon textiles, cigars, cigarettes, and cotton garments—and on a study of the mechanization of selected operations and processes in large offices. A study of capital growth in the automobile and allied industries from 1925–1933 is also under way. The Employment Stabilization Research Institute of the University of Minnesota is cooperating on a study covering changes in equipment, efficiency of labor, job specifications, and occupational requirements in a number of Minneapolis manufacturing plants for a comparative analysis with the results of a similar study by the Institute five years ago.

Studies in the extractive industries are being conducted in cooperation with the U. S. Bureau of Mines. The work of tabulating materials from the files of the Bureau and amplifying these by field contacts is well advanced. Reports on the individual industries are in preparation.

In a study of the effects of changes in techniques, mechanical equipment, farm practices and market requirements on the volume of employment and production in agricultural pursuits, data have been assembled from the files of the U. S. Department of Agriculture, experiment stations and other sources, and reports are now being prepared. The tabulation of results of a field survey is nearing completion.

A study of the history of technological changes in the railroad industry and their effects on operating efficiency and on railroad labor is under way in cooperation with the Railroad Retirement Board. This study comprises (1) an intensive survey of the history of mechanical and managerial changes and their effects on railroad labor, including employment, earnings, and productivity; (2) an analysis of population changes, trends in earnings, and periods of separation from the railroad service between 1924 and 1933, based on 400,000 personnel and earnings records collected by the Federal Coordinator of Transportation; (3) a field survey of about 4,000 railroad employees, covering employment and unemployment history and data on training and service status. The latter study is designed to supplement the analysis of employment records by bringing them up to date, by adding the record of employment in other industries during periods of separation from the railroad and by distinguishing employment according to its regularity or intermittency.

Surveys of the Effects of Industrial Changes on Labor Markets and on Individual Workers. Another major division of the Project is concerned with the determination and interpretation of employment and unemployment experiences of workers in various industrial situations. Field work in a number of selected localities has now been completed and, in addition, considerable work history material previously collected by other agencies is being analyzed. The Industrial Research Department of the University of Pennsylvania is cooperating on a series of these labor market surveys, in Philadelphia.

The emphasis of the surveys is primarily on employment histories, for the years 1926–1936, of workers in labor market situations in various industries, occupations, and geographic locations. Approximately 18,000 histories have been obtained from the field. Some of the surveys cover single-industry localities; in other cases, the study is concerned only with selected industrial or occupational situations in a diversified labor market. In each case the history of industrial activities and the related history of the working population were surveyed as they pertain to the situation selected for inquiry. Against this historical background, analyses will be made of present employment status of the population and of recent work histories of individuals. In several instances supplementary analyses are being made of personnel, payroll and earnings records of employing concerns.

DIVISION OF PUBLIC ASSISTANCE STATISTICS, SOCIAL SECURITY BOARD.—Since February 1, 1936, this Division has collected monthly reports on old-age assistance, aid to dependent children and aid to the blind from States participating in the administration of public assistance under the Social Security Act. The results of this collection of data are published in three series of publications: (1) a monthly bulletin entitled *Public Assistance, Monthly Statistics for the United States*, of which eleven numbers have been issued, the most recent number covering data for November, 1936; (2) a quarterly bulletin entitled *Public Assistance, Quarterly Review of Statistics for the United States* with a supplement containing data for each county, three numbers of which have appeared, the last for the quarter ending September 30, 1936; (3) a mimeographed report issued on the first of each month giving estimates for the current month, estimates for the preceding month and actual data for the second preceding month.

Accuracy and completeness of data collected through this State reporting system is the first goal of the eleven field representatives of this Division who are assigned to the twelve regions of the Social Security Board. General guidance to State and local statisticians through these field representatives is expected, however, to result in general improvement in State and local organization and procedure for the collection of public welfare statistics.

On November 1, 1936, State agencies cooperating with the Social Security Board began the collection of social information about cases accepted and closed, in accordance with detailed forms and instructions issued by this Division. It is expected that comprehensive social statistics about recipients of public assistance will be produced by this plan.

Since June 1, 1936, this Division has been responsible for the collection, analysis and publication of relief data from 118 urban areas, formerly reporting to the U. S. Children's Bureau. Results of the collection of these data are published in *Changes During the Month in Different Types of Public and Private Relief in Urban Areas*. The most recent number of this bulletin with data for October 1936 was issued on January 21, 1937.

During January 1937 an agreement was reached to transfer the Rural and Town Relief Reporting Sample, formerly the responsibility of the Division of Social Research of the Works Progress Administration to this Division of the Social Security Board before July 1, 1937.

The Division has been cooperating with the Works Progress Administration in the collection of general relief statistics throughout the United States under an interim agreement for the six months period, October 1, 1936, through March 31, 1937. A procedure for an integrated reporting system which will eliminate duplications in the count of cases of general relief and special forms of public assistance for State and local agencies administering more than one form of assistance is expected to be completed in the near future.

For assistance to its Division of Public Assistance Statistics the Social Security Board on June 12, 1936, requested the American Statistical Association and the American Public Welfare Association to form a joint advisory committee. This committee was chosen by the two associations and elected Ralph Hurlin of the Russell Sage Foundation, chairman, and Paul Webbink of the Committee on Social Security of the Social Science Research Council, secretary. The other members are: Neva R. Deardorff, Director, Research Bureau, Welfare Council of New York City; Emil Frankel, Director of Research, New Jersey State Department of Institutions and Agencies; Harry Greenstein, Director, Associated Jewish Charities of Baltimore; Howard Myers, Director, Division of Social Research, Works Progress Administration; and Frederick F. Stephan, Secretary of the American Statistical Association. Morris Copeland, Executive Secretary of the Central Statistical Board, also meets with the Committee.

WOMEN'S BUREAU, U. S. DEPARTMENT OF LABOR.—"The Employed Woman Homemaker in the United States" has recently been released as Women's Bureau Bulletin 148. This is an analysis of unpublished data made available by the Bureau of the Census and will later be supplemented by material compiled from original census data on the family responsibilities of all gainfully occupied women in certain large cities.

Bulletin 147 is a "Summary of State Reports of Occupational Diseases with a Survey of Preventive Legislation." All data available by sex for the years 1932 to 1934 inclusive are here assembled from published and unpublished sources. The bulletin is one of a regular series of reports on occupational diseases and contains valuable reference tables.

The Bureau's report on a recent survey of women's wages, hours of work, and conditions of employment in the State of Tennessee is now in press. In many establishments data were secured also for men employees. In all, 267 plants employing over 29,000 women were visited. One of the most interesting features of the report is the comparison of conditions in 1934 and 1935. In many industries there had been a decided breaking away from the standards set by the N.R.A., but in a few industries the wages improved slightly.

OFFICE OF EDUCATION.—The February issue of *School Life* will have an article on enrollment in commercial subjects in public high schools, the first of a series of preliminary data in this field. The March issue will carry data on enrollments in mathematics subjects.

All chapters of the *Biennial Survey of Education, 1932–34*, are either in bulletin form or in page proof.

"Per capita costs in city schools, 1935–36," Pamphlet No. 70, is in process of printing. A photostat copy of the table for cities of 100,000 population and more is available for loan from the Office of Education.

CONFERENCE ON RESEARCH IN NATIONAL INCOME AND WEALTH.—This Conference, organized in January, 1936,[1] held its second meeting on January 29 and 30 at Hillside, the Riverdale property of the National Bureau of

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[1] See this JOURNAL, March 1936, pp. 130–31.

Economic Research. The meeting was attended by representatives from the Universities of Harvard, Columbia, Minnesota, and Wisconsin; from the Central Statistical Board; the Bureaus of the Census, of Agricultural Economics, of Foreign and Domestic Commerce, of Labor Statistics; Division of Research and Statistics of the Treasury; Divisions of Research of the Federal Reserve Board and of the Federal Deposit Insurance Corporation; the Industrial Division of the National Resources Committee; the Brookings Institution, the National Industrial Conference Board, Dun and Bradstreet, and the National Bureau of Economic Research.

Following the submittal and discussion of the report by the Executive Committee on its activity during 1936, the Conference discussed at length the various directions in which cooperative activity in the field could best be furthered in the immediate future. Noting the great value of the data available on the state income tax returns for the study of the distribution of income by size, the Conference approved the efforts made by the Executive Committee to have such data tabulated and made available for use by students in the field. Such tabulation has already been initiated by the State of Wisconsin, and there are promising prospects of having it undertaken for Delaware. The Conference indicated the advisability of obtaining the services of a competent person to devote his time to this work on increasing the primary data bearing on the distribution of income and wealth by size among individuals and families, whether such data be on income tax returns or result from any other statistical surveys. Since such information would prove particularly useful when cross-classified with the regional allocation of income and wealth, the Conference emphasized the value of exploratory work in this direction that could be undertaken by state planning boards and other state agencies, perhaps with the assistance of the National Resources Committee.

Another direction in which cooperative activity developed during 1936 was the initiation of discussion of various problems in the field by individual students, who would submit reports at the annual meetings of the scientific associations and at the meeting of the Conference proper. It was thought that this experiment proved to be quite successful. The reports submitted by Gerhard Colm, Carl Shoup, O. C. Stine, and Solomon Kuznets at the December meetings of the American Economic and American Statistical Associations represented significant contributions toward the solution of the problems discussed. It was recommended that this experiment be continued; that the reports so submitted, as well as the discussion to which they give rise, be published upon review by an editorial committee, as studies of the Conference, the National Bureau being requested to act as publisher.

The Conference has discussed at length the report by M. A. Copeland on *Concepts of National Income*, by Solomon Fabricant on *Treatment of Corporate Savings in National Income*, and by Simon Kuznets on *Adjustment of National Income Totals for Revaluation of Inventories*. These reports were initiated by the special subcommittee on Income Concepts and Terminology set up in 1936 (M. A. Copeland, Chairman; W. W. Riefler and Simon Kuznets, members). The publication of these reports and of the discussion that developed in connection with them, again upon review by the editorial committee, was recommended. The Conference has also approved the continuation of the subcommittee on Income Concepts and Terminology, as constituted in 1936; the ultimate objective of its work being the establishment of the main points on which agreement existed and the precise formulation of the questions which would still be at issue.

An Executive Committee was elected comprising: Simon Kuznets, Chairman; M. A. Copeland, W. L. Crum, H. M. Groves, G. C. Means, R. R. Nathan, and O. C. Stine.

CONFERENCE ON PRICE RESEARCH.—During the past year substantial progress has been made in developing the program of the Conference on Price Research. (See this JOURNAL, March, 1936, pp. 128–131.) Last summer the Executive Committee authorized exploratory studies in five important industries: steel, petroleum, textiles, automobiles, and coal. For each of these industries a committee composed of research men from universities and other institutions and of representatives of the industry has been set up. Each committee is to define the industrial and economic problems centering in prices and price relations, summarize present knowledge, appraise existing data, and outline a program of research.

Preliminary reports from the steel and textile committees were presented at a round table held in connection with the annual meeting of the American Statistical Association. Another round table, dealing with the general objectives of price research in American industries, was held as one of the meetings of the American Economic Association. The papers presented dealt with industry studies and the nature of competition, industrial price policies and the attributes of industrial prices, and with industrial productivity and prices. It is expected that the five committee reports will be published.

As a basic step in the program to coordinate price research, the Conference has undertaken an inventory of current research projects in this field. Letters requesting information have been sent to persons known to be engaged in price research. Details concerning projects recently undertaken are requested. Such information should be sent to the Conference on Price Research, c/o National Bureau of Economic Research, 1819 Broadway, New York City. It is hoped that this survey will be completed early in 1937, at which time a report will be sent to all who have collaborated in the inventory.

NATIONAL BUREAU OF ECONOMIC RESEARCH.—*Prices in Recession and Recovery* by Frederick C. Mills appeared December 11, 1936. In this 570-page book Dr. Mills analyzes the price movements of recovery against the record of the recession and pre-recession situation. Separate chapters treat of the position of the farmer and other primary producers, the manufacturing industries, producers of capital goods, and consumers. In the Appendix are given the basic price index numbers, monthly from 1929 to 1936, which have appeared from time to time in National Bureau publications.

Two *Bulletins* (Numbers 62 and 63) were published in December: *Revaluations of Fixed Assets, 1925–1934* by Solomon Fabricant and *The Recovery in Wages and Employment* by Leo Wolman. The 1937 series will be started, subject to the approval of the Directors, with a double issue, *The Agricultural Crisis*, by Drs. Eugen Altschul and Frederick Strauss. This report, which analyzes in detail the crisis in wheat and in cotton, is one of the products of the investigation by these authors into the relationship of agriculture and business cycles, made possible by a grant from the Falk Foundation. A full report will be issued in book form at a later date. An agreement for cooperative research with the U. S. Department of Agriculture will turn Dr. Strauss' attention this year to an historical study of the interrelations of agriculture and industry.

The National Bureau has announced that an Associate Membership in the organization is now available. Dues are one-fifth those of full membership. Associate Members receive the *Bulletin*, the Annual Report, and a substantial discount on the purchase of National Bureau books.

The National Bureau's Annual report has been prepared this year by Dr. Willits, its Executive Director. The report will be published, as usual, following the Annual Meeting of the Board of Directors on March 1.

INDUSTRIAL RELATIONS COUNSELORS, INC.—A twenty-nine-page monograph entitled *Industrial Pension Systems in the United States and Canada—Certain Phases of Pension Activities for the Years 1931–1934*, has just been completed. It supplements the two-volume work on *Industrial Pension Systems in the United States and Canada* by M. W. Latimer published in 1932. The monograph summarizes the experience reported by 145 companies which employ a vast majority of the persons covered by formal plans. In addition, it includes data for railroad plans taken from the annual reports of the Interstate Commerce Commission and for reinsured plans supplied by insurance companies. Nine tables are presented.

Industrial Relations Counselors, Inc., also has in preparation a study of unemployment insurance administration, based on the organization and administrative procedures of five jurisdictions—Wisconsin, New York, California, New Hampshire and the District of Columbia.

NATIONAL INDUSTRIAL CONFERENCE BOARD.—The Board's studies in the field of national income, initiated by the volume of Mr. Robert F. Martin on *National Income and Its Elements* have been continued by the issue of a volume by the same author on *Income in Agriculture, 1929–1935*. The significant feature of the treatment is that for the first time, net agricultural income estimates have been made by geographic regions. Account has been taken of the part-time nature of a large proportion of the enterprises included in the agricultural statistics, and allowance made for income received by part-time operators for labor away from the farm. Account is taken of the fact that for comparison with other classes the value of the products consumed on the farm—a part of farm income should be rated at the prices paid by non-farm families. The upshot of this detailed survey is the conclusion that instead of a generally depressed condition in agriculture since 1929, there has been a series of special farm problems affecting special products and regions.

There have been further special studies of income published in the *Conference Board Bulletin*, which is issued for the information of Associates of the Board. Through press releases the major aspects of these studies have been made available to the public at large. They have concerned a further analysis of income in transportation, and income in manufactures. The Board published estimates of income by states for 1929 and 1933 in its *National Income and Its Elements*. Its investigators are now engaged in a study of the geographic distribution of income in all the years 1929 to 1935. This study will deal with the industrial source of income, and the classification of income by type. As a part of this study the Distribution by States of Income from Manufacturing Industry has been treated in the *Conference Board Bulletin*, and a similar treatment of income from mining and from transportation is expected at a comparatively early date.

The income studies of the Board have afforded the basis for a study of "Estimated Payroll Taxes for Unemployment Compensation" (*Bulletin*, January 15, 1937) and will be utilized for a similar study of taxes growing out of the old-age benefits provided by the Social Security Act.

The Board has resumed its Unemployment estimates. An article (*Bulletin*, November 13, 1936) on New Estimates of Employment, Unemployment and the Labor Force gave estimates at quarterly intervals in the years 1930 to 1934, and monthly estimates from January, 1935 to September, 1936. Figures for October and November of last year have been issued in the form of press releases, and similar issues are to be made monthly hereafter.

Work in progress includes among other things an analysis of railroad passenger traffic in relation to railway operations and revenues, and a similar study of railway freight movement, a survey of personnel practices in factory and office administration in a large number of enterprises, a further survey of skilled labor shortage, and the annual study of the Cost of Government.

POPULATION INDEX.—The first number of *Population Index*, a guide to current demographic materials for students, research workers and teachers appeared in January. The *Index* is published quarterly by the School of Public Affairs, Princeton University, and the Population Association of America. It continues the Association's bibliography, *Population Literature*. The current number contains two entirely new sections, Current Items and Statistics, in addition to a bibliography covering more than 400 recent books and articles.

CHAPTER ACTIVITIES

THE ALBANY CHAPTER.—On November 10 the Chapter met to discuss "Statistics in Federal Agencies." A meeting was held on December 1 at the Rensselaer Polytechnic Institute in Troy, New York, at which Mr. C. M. Armstrong, Jr. of the General Electric Company spoke on "Statistical Control of Quality in Manufacturing Operations."

The Albany Chapter of the American Statistical Association met on Tuesday evening, February 2, 1937, at the Candle Light Inn in Albany for dinner and program. Professor E. H. Van Winkle of the Rensselaer Polytechnic Institute gave an interesting illustrated talk on the use of graphs in presenting statistical material. Considerable discussion as to the use of various types of graphs followed the talk. There were 42 members and guests present.

The Chapter held five meetings during 1936 with an average attendance of 24 persons per meeting. There were 39 members of the Chapter at the end of the year.

THE AUSTIN CHAPTER.—The Austin, Texas, Chapter held its first meeting of the academic year 1936–37 on October 22, at the Union Building on the campus of The University of Texas with 20 present. The principal speaker was Dr. Edward L. Dodd, Professor of Actuarial Mathematics, The University of Texas, and one of the lecturers invited to conduct the advanced seminars in Economics and Statistics held during the past summer under the sponsorship of the Cowles Commission for Research in Economics. Dr. Dodd discussed the work of the Cowles Commission and summarized some of the discussions in the recent seminars.

A second meeting was held November 19, with 25 present, at which Mr. Frank Haynes, of the United States Weather Bureau, spoke on the "Work of the Weather Bureau."

On December 8, 1936, the Austin Chapter held a special meeting with Dr. Isador Lubin, United States Commissioner of Labor Statistics, as the guest of honor. Twenty-seven were present. Dr. Lubin spoke briefly of the work of the Bureau of Labor Statistics and of the Central Statistical Board.

The third regular meeting of the year was held January 21, 1937. The principal address was by Mr. Harold K. Tinsley, of the Cotton Marketing Division of the United States Department of Agriculture, whose subject was "Cotton Grade and Staple Statistics Projects of the United States Bureau of Agricultural Economics."

The Austin Chapter had five meetings during 1936 with an average attendance of 25 persons a meeting. There were 37 members at the end of the year of whom seven are members of the American Statistical Association.

THE BOSTON CHAPTER.—The Ninth Annual Meeting of the Boston Chapter was held at the Boston City Club on Friday evening, December 4, 1936.

At the business session the following officers were elected to serve during the ensuing year: President, Professor Donald S. Tucker, Massachusetts Institute of Technology, Vice-President, Paul T. Babson, United Business Service, Secretary-Treasurer, Roswell F. Phelps, Massachusetts Department of Labor and Industries, Directors, Edmund S. Cogswell, Massachusetts Department of Insurance and T. Frederick Brunton, John Hancock Mutual Life Insurance Co.

The general subject for discussion at this meeting was "Certain Statistical Phases of the Social Security Program." Mr. E. R. Livernash of the Massachusetts Institute of Technology spoke on the subject—"Unemployment Compensation in Colorado" and presented the results of a study which he had recently made of the probable operation of the unemployment compensation plan in Colorado. He stated that in his opinion industries like the steel industry and other heavy industries are likely to make more frequent calls on the insurance reserves than industries which produce consumers' goods, and some lines of business would benefit at the expense of others. In Colorado, about fifty per cent of the total number of employed persons would be covered by unemployment compensation and only about twenty-nine per cent would have been covered in 1935 due to shifts in industrial activity. There are also many unemployed persons who become ineligible after exhausting their benefits due to the long duration of their unemployment. The largest group of unemployed was the group which was unemployed for the longest period of time. One large group consisted of coal miners in the southern coal fields of the State, whose unemployment was due to a combination of seasonal, cyclical and technological causes. According to the survey in Colorado, unemployment compensation in that State will provide for those unemployed for short, recurrent periods, but will not provide effectively for those unemployed for long periods of time.

Mr. Louis R. Lipp, Assistant Superintendent of the Massachusetts Division of Old Age Assistance, described the Old Age Assistance System in Massachusetts. The State funds for this purpose are derived largely from liquor license fees and racing taxes. The special poll tax which had been levied for this purpose has been discontinued. There is a rapidly increasing expenditure for old age assistance and no probability of a decrease in the number of cases, because the contributions from the National Social Security System during the next fifteen years, at least, will be too small to result in a reduction in the number of aged persons who will require assistance. The Federal Government, however, is now contributing toward the funds for this purpose and the burden to be borne by the State should eventually be somewhat reduced.

On December 1, 1936, the membership of the Chapter was 101, all of whom are members of the American Statistical Association.

THE CHICAGO CHAPTER.—At a meeting on October 27, 1936, Dr. Joseph S. Davis, President of the American Statistical Association and Director of the Food Research Institute, Stanford University, lead an open forum discussion of "The Long Term Trend of Farm Prices." At a meeting on December 1, Dr. Garfield V. Cox, Professor of Finance at the University of Chicago, presented "An Analysis of the Inflation Problem." Mr. A. T. Kearney of the McKinsey Wellington & Company spoke on "What Use is Industry Making of Research and Statistics?" at a meeting of the Chapter on January 26, 1937.

The Chapter met six times during 1936 with an average attendance of 64 persons per meeting. At the end of the year there were 103 members in good standing of whom 31 are members of the American Statistical Association.

THE CLEVELAND CHAPTER.—Twenty-nine members and guests were present at the second meeting of the 1936–37 season for the Business Statistics Section held on October 26. Mr. John Love, columnist for the Cleveland Press, delivered an address concerning his observations while visiting Russia during the past summer. The third meeting took place on November 23, at which Mr. William Frew Long, General Manager of Associated Industries of Cleveland, was the speaker. His subject dealt with employee-employer relations in England and how they differ with the situation in this country. Twenty-three members and guests were present. On January 11, the fourth meeting was given over to a discussion of the annual meeting of the Association held in Chicago. The Cleveland Chapter was well represented at the Chicago meeting. The members who had not attended the Chicago sessions were well rewarded for their presence at the luncheon.

The Business Statistics group of the Cleveland Chapter met five times during 1936 with an average attendance of 21 persons. The Annual Meeting of the Chapter was held in May. At the end of 1936 there were 35 members of the Chapter of whom 18 are members of the American Statistical Association.

THE CONNECTICUT CHAPTER.—There were five meetings of the Connecticut Chapter during 1936 with an average attendance of 15 members. At the end of the year there were 82 active members in the Chapter.

THE NEW YORK DISTRICT CHAPTER.—Taking their cue from the international "gentlemen's agreement" of September 25, the various speakers at the November 9th dinner meeting of the New York Chapter of the Association discussed divergent phases of the past, present and possibly future course of world monetary affairs. The subject was discussed first by Professor Edwin A. Kemmerer of Princeton who, with his characteristically clear and practical grasp of currency matters, outlined the merits and shortcomings of the "gentlemen's agreement." In the first place, he stated, it was a definite achievement to have the three leading countries, Great Britain, France and the United States, actually reach a basis of cooperation. Secondly, it does provide a means of settling international clearings. Doctor Kemmerer also drew a grain of encouragement from the "declaration of intention" of the interested nations to work for a reduction of trade restrictions. At the same time he pointed out that the agreement provided no monetary basis for international stabilization, no standard of value in terms of gold or otherwise. Further, it covers no definite period of time but represents merely a day-to-day arrangement.

Professor Kemmerer digressed here to review the history of the gold standard, pointing out that until the World War it had proved the best basis for a sound currency system despite its faults. The system broke down badly, however, as a result of the war and for two years after the signing of the Armistice. By 1927 most of the leading nations of the world were back on the gold standard and the period 1921–1929 was characterized by a relatively high degree of price stability. With the decline in commodity prices that began in 1929, there began a scramble for gold that culminated in the disruption of the leading currency systems.

Speaking of devaluation, Professor Kemmerer stressed the fact that its benefits were temporary for it constituted a wealth-exhausting process. The ability to maintain a stable currency, difficult in the face of the political temperament today, paid the best dividends in the long run. He concluded his remarks, however, with the observation that the "gentlemen's agreement," perhaps only a short step in the right direction, nevertheless suggested eventual resumption of the gold standard internationally.

The next speaker, Mr, Robert B. Warren, economist for Case, Pomeroy & Company, summarized his approach to the subject under three headings: (1) A factual interpretation of the "gentlemen's agreement" of September 25 and its supplemental announcement; (2) A description of the ideological conflict which in recent years has produced world-wide monetary anarchy; (3) A summary of the findings of the British Royal Commission of 1931, which attempted to find a rational solution of this conflict. Thus Mr. Warren presented "an objective description of contemporary monetary policy, citing the MacMillan report as a statement of its ideology, and the British practice as the most completely formulated example of that ideology, providing a pattern to which other nations appear to be conforming . . . then . . . to fit the agreement into its place as a significant episode in the evolutionary stream of monetary theory and practice."

Mr. Warren's summary of the "gentlemen's agreement" emphasized the fact that it did not represent a stabilization compact but outlined a *modus operandi* for international monetary intercourse, acknowledged that the international value of their respective currencies are a matter of mutual concern to the interested parties, adopted gold as the international medium of exchange, and provided the stabilization or equalization fund as the mechanism for carrying on the joint relationship.

A review of the so-called "ideology of money" cited the ancient conflict between the advocates of the theory of money as a repository of value and those who considered its primary function as a medium of exchange, that it need have no value in itself but should be accepted by society as a creature of the State. Bringing the controversy down to modern times, Mr. Warren touched upon recent unhappy monetary history and attached great significance to the conclusions of the MacMillan report as a possible solution to the problem. The salient features of the Commission's report called for the use of gold *only* to meet deficits in the international balance of payments and, secondly, that the situation called for a managed currency for domestic purposes. The principles thus laid down and followed in their essentials by Great Britain with apparently considerable measure of success seem destined for wider application under the "gentlemen's agreement."

Striking off on a more pessimistic note, Dr. Walter E. Spahr, Professor of Economics at New York University, drew small comfort from the agreement as indicative of a satisfactory permanent monetary mechanism for the United States, either internationally or domestically. Professor Spahr characterized the "gentlemen's agreement" as follows:

(1) It said nothing tangible about currency stabilization and
(2) It is a rare collection of pious platitudes. I think one could study that document till doomsday and not know what the monetary policy of the United States is or is to be.

Further currency tinkering is looked for, with this Administration committed to a managed currency and/or commodity dollar. Public apathy in failing to bring pressure to bear for a sound currency system is decried by Professor Spahr, who further suggests that our immediate task is

(1) to watch our government constantly in matters involving our currency, and to let the government know that it is being watched, in the hope that this may have some beneficial effect, and
(2) to urge that no further steps be taken until an expert, non-partisan commission has been appointed to study our money and banking problems, and to hold open hearings and to draft model money and banking laws. At that time, plans for international stabilization of currencies would receive appropriate consideration.

The general discussion that followed the regular speeches centered about Doctor Gustav Stolper's pithy remarks concerning the facts and conclusions presented by the other speakers. He took issue with Mr. Warren particularly, attributing the disruption of the international currency situation to the vast and economically unsound increase in the world debt, culminating in the deflationary spiral set off by the collapse of the Austrian Credit-Anstahlt.

There seems little doubt that we are watching important monetary history in the making. *J. Ross Haas, Moody's Investors Service.*

The New York District Chapter held three meetings during 1936 with an average attendance of 240. Approximately 675 members of the American Statistical Association live in or near New York and under the provision of the Chapter's constitution are members of the Chapter.

THE PHILADELPHIA CHAPTER.—"Problems of International Currency Stabilization" were discussed by the Chapter at the meeting on December 11, 1936. There were two principal speakers. Dr. Amos Taylor of the Finance Division, U. S. Department of Commerce, spoke on "Methods Employed in Compiling Data on International Investment"; Mr. Walter Gardner of the

Division of Research and Statistics, Board of Governors of the Federal Reserve System, spoke on "International Gold Movement."

There were four meetings of the Chapter during 1936.

THE PITTSBURGH CHAPTER.—The Chapter met on September 24 to hear a discussion on the degree of recovery and probable future activity in three major lines of business activity. Mr. G. A. Doyle of the Bell Telephone Company of Pennsylvania spoke on "Communication;" Mr. David Tynberg of Kaufmann's Department Store spoke on "Merchandizing;" and Mr. B. E. V. Luty of the *American Metal Market* sent a paper on "Steel" which was read in his absence by Mr. Bervard Nichols of the Bureau of Business Research, University of Pittsburgh.

On October 22, luncheon and evening meetings were addressed by Mr. Claude E. Robinson who interpreted the Presidential polls conducted by various newspapers and magazines.

The Chapter held ten meetings during 1936 with an average attendance of 30 persons. At the end of the year there were 68 members of the Chapter of whom 23 are members of the American Statistical Association.

THE SAN FRANCISCO CHAPTER.—Dr. M. K. Bennett, Food Research Institute, Stanford University, spoke before the San Francisco Chapter on November 12, 1936, on "The Measurement of Relative National Standards of Living." A summary of his paper follows:

Standards of living was defined as the per capita quantum of goods and services used by national groups. The countries considered were United States, British Isles, Germany, France, Italy, Spain, Portugal, Belgium, Holland, Switzerland, Denmark, Norway, Sweden, Finland.

Goods and services for consumption fall into five categories: professional services, transport and communication, food, clothing, and shelter. Theoretically, measures of relative national standards of living ought to cover each of these fields. But specific measures ought not to take account of the most basic requirements of life such as the crudest forms of food, shelter, and clothing; or of goods and services which are exotic or peculiar and not universally desired.

The practical problem is to find statistical series which together cover all fields of standard of living. But none could be found which gave useful indications of relative national per capita standards of clothing and housing. Fourteen series seemed serviceable to cover the other three fields: death rates per 1,000 inhabitants (inverted); birth rates (inverted); percentage of total occupied population engaged in professional service; percentage of population age 5–20 attending elementary and secondary schools; pieces of mail per capita handled by postal services; telephone instruments per 1,000 inhabitants; mileage of telephone and telegraph wire per 100,000 inhabitants; telegraph messages sent per 1,000 inhabitants; railway locomotives per 1,000 inhabitants; motor vehicles per 1,000 inhabitants; raw sugar per capita domestically retained; tobacco per capita domestically retained; tea, coffee, and cacao domestically retained; citrus fruits and bananas domestically retained.

It was admitted that none of these indicators could be regarded as precisely appropriate or precisely accurate. They were, however, combined (a) by a process of ranking and scoring and (b) by a process of conversion to index numbers and averaging. The resulting general indexes gave results as follows, when group averages were taken as 100 (numbers in parentheses representing weighted averages of 14 index numbers for each country): United States, 166 (188); British Isles, 135 (122); Denmark, 130 (126); Switzerland, 125 (114); Holland, 118 (114); Belgium, 118 (108); Sweden, 110 (109); Germany, 110 (101); Norway, 107 (102); France, 106 (96); Finland, 50 (66); Italy, 49 (57); Spain, 48 (51); Portugal, 28 (42).

In conclusion, it was stated that these general indexes could not be trusted as close measures of differences in national standards of living, but that they probably sufficed to differentiate between five groups of countries and that large differences in the indexes were presumably indicative of large differences in standards of living. It was suggested that the method perhaps had sufficient validity to warrant its application to a longer list of countries with illuminating results.

On September 30, at the end of the fiscal year of the Chapter there were 105 members, of whom 23 are members of the American Statistical Association. The Chapter held five meetings during 1936 with an average attendance of 36 persons.

THE WASHINGTON STATISTICAL SOCIETY.—A discussion of "The Business Outlook in 1937" was the subject of a meeting of the Washington Chapter on December 1, 1936. The speakers were Eric Englund, Bureau of Agricultural Economics, "The Agricultural Outlook in 1937;" Frank R. Garfield, The Board of Governors of the Federal Reserve System, "Industrial Production in 1937;" Emerson Ross, Works Progress Administration, "Public Works and Employment;" Woodlief Thomas, Board of Governors of the Federal Reserve System, "Credit, Banking and the Capital Markets;" and Louis Bean, Department of Agriculture, "Summary of Forecasts."

The Chapter met on January 13, 1937, at George Washington University. The topic of discussion was "Measuring Unemployment." The program for the evening included three speakers, Mr. Ewan Clague of the Social Security Board presiding. The first speaker on the program, Mr. Howard B. Myers of the Works Progress Administration, spoke on the subject of "What We Need to Know about Unemployment." After stressing the limited amount of current data on unemployment, he proceeded to outline the information essential for an intelligent attack on the problem. Among the more important items, Mr. Myers listed (1) the number of persons out-of-work and their geographical distribution; (2) duration of unemployment; (3) such primary characteristics as age, sex, color, education, etc.; (4) employment and unemployment histories; (5) previous occupations and present abilities; (6) causes of loss of employment; (7) need for training or retraining; (8) employment trends and future employment prospects; (9) geographical and occupational mobility of the unemployed; (10) resources of unemployed persons and their families; (11) incidence of unemployment within family groups; (12) effects of unemployment on individuals and family life. These items were offered not as a complete outline of needs, but merely as a starting point in a survey of needed information.

Mr. Myers was followed by Mr. John N. Webb, also of the Works Progress Administration, who read a paper on "Limitations of the Census Method." Mr. Webb maintained that the census method was adaptable to the enumeration of comparatively simple phenomena that changed slowly in time, and that unemployment was too complex and too dynamic to lend itself to such a method. He pointed out that in the absence of a workable and generally acceptable definition of unemployment, an unemployment census could not be relied upon for an accurate count of the unemployed. Mr. Webb then proceeded to demonstrate, using examples drawn from field studies, that the census method would not readily provide satisfactory information on duration of unemployment, and, in many instances, on the occupations of the unemployed and the industries from which they came. In conclusion, he suggested that the extensive developments of sampling techniques in recent years be applied to the measurement of unemployment until such time as a reliable national reporting system is devised.

The last scheduled speaker of the evening was Mr. Calvert L. Dedrick of the Census Bureau. Mr. Dedrick spoke on the "Merits of the Census Method." Mr. Dedrick conceded that an unemployment census would not furnish: (1) current data on unemployment; (2) case work details on employability; (3) causes of unemployment; or even (4) a scientifically accurate and uniform definition for all the unemployed. Such data, he stated, are required by those in charge of placement and relief, and they are available, to a much larger extent than is usually realized, for the relief population and for all persons currently registered with the U. S. Employment Service. Although these data are adequate for immediate tasks they do not provide a sufficient coverage for long time planning of a social security and relief program. Mr. Dedrick pointed out that the principal use of a census of employment and unemployment at this time would be to serve as a base line for current data and a comprehensive inventory of certain major population and employment categories. A number of new statistical series are likely to result from the administration of the Social Security Act, and these series will increase the usefulness of current statistics now secured, if an adequate common base is provided by a national census.

Before the discussion from the floor began, Mr. William E. Stead of the U. S. Employment Service spoke on the registration and placement activities of his organization and the extent to which it could be depended upon to furnish comprehensive unemployment statistics in the future, and Mr. Clague stressed the need for data by the Social Security Board on the duration of unemployment.

There were four meetings of the Chapter during 1936 with an average attendance of 90 persons. Approximately 359 members of the American Statistical Association live in or near Washington and under the provision of the Chapter's Constitution are members of the Chapter.

NEW MEMBERS

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Weinfeld, William, Director of Minneapolis Statistical Pool, Study of Consumer Purchases (Department of Agriculture, Bureau of Home Economics), 303 New Post Office Building, Minneapolis, Minnesota

Westefeld, Albert, Junior Statistician, Division of Social Research, Works Progress Administration, 1734 New York Avenue, N. W., Washington, D. C.

Whiteside, Henry O., Research Assistant, Bureau of Social Research of Federation of Social Agencies of Pittsburgh and Allegheny County, 519 Smithfield Street, Pittsburgh, Pennsylvania

Williams, Dr. John H., Professor of Economics, Harvard University and Vice-President of Federal Reserve Bank of New York, 33 Liberty Street, New York City

Wilson, Harry D., Assistant Supervisor Finance and Statistics, District #2, Works Progress Administration for Illinois, 2nd Floor, Merchandise Mart, Chicago, Illinois

Winey, Harold E., Director of Research, Dayton Bureau of Community Service, 225 North Jefferson Street, Dayton, Ohio

Winslow, Harry J., Associate Statistician, Social Security Board, Room 404, National Theatre Building, Washington, D. C.

Youden, Dr. William J., Physical Chemist, Boyce Thompson Institute for Plant Research, 1086 North Broadway, Yonkers, New York

Zubin, Dr. Joseph, Assistant Psychologist, U. S. Public Health Service, c/o The National Committee for Mental Hygiene, 50 West 50th Street, Room 822, New York City

PROCEEDINGS

Ninety-eighth Annual Meeting

STEVENS HOTEL, CHICAGO

PROGRAM

Monday, December 28, 1936

—10:15 A.M.—

I. STATISTICS AND ECONOMETRICS

(With Econometric Society and Institute of Mathematical Statistics)

Chairman: Irving Fisher, Yale University

The General Welfare

Harold Hotelling, Columbia University

Some New Indexes of Agricultural Supplies and Carryover

E. J. Working, University of Illinois

New Indexes of Stock Prices and Yields and Their Relation to the Theories of Capital and Savings

Charles F. Roos, Cowles Commission for Research in Economics

Discussion: Louis H. Bean, U. S. Department of Agriculture
Willard L. Thorp, Dun and Bradstreet, New York City

II. CONSTRUCTION AND REAL PROPERTY STATISTICS

Chairman: Morris A. Copeland, Central Statistical Board

Problems of Measuring Currently the Volume of Building Construction

David L. Wickens and Ray R. Foster, National Bureau of Economic Research

Construction Cost and Value Indexes

Frank R. Garfield, Board of Governors of the Federal Reserve System, and William M. Hoad, Central Statistical Board

The Use of County Records of Deeds and Mortgages to Provide Current Indexes of Real Estate Transfers and Changes in Mortgage Status

Donald Jackson, Bureau of Agricultural Economics, and L. Durward Badgley, Federal Housing Administration

The Use of Current Sampling Inquiries to Measure Rents and the Occupancy and Vacancy of Property

Howard G. Brunsman, Federal Housing Administration

III. TEACHING STATISTICS IN SCHOOLS OF BUSINESS

Chairman: F. Leslie Hayford, General Motors Corporation, New York City

Developing Judgment in the Use of Statistics

Theodore J. Kreps, Stanford University

Notes on Instruction in Business Statistics

Olin W. Blackett, University of Michigan

The Teaching of Business Statistics

Theodore H. Brown, Harvard University

Discussion: John W. Scoville, Chrysler Corporation, Detroit, Michigan
Ralph C. Epstein, University of Buffalo

MONDAY, DECEMBER 28, 1936

—10:15 A.M.—

IV. STATISTICAL REQUIREMENTS OF SOCIAL INSURANCE PROGRAMS
(With American Association for Labor Legislation)
Chairman: Isador Lubin, Bureau of Labor Statistics
Arthur J. Altmeyer, Social Security Board
George E. Bigge, Brown University
Christian E. Jarchow, International Harvester Company
Discussion: S. M. DuBrul, General Motors Corporation
Ewan Clague, Social Security Board
Aryness Joy, Central Statistical Board
M. B. Givens, New York Department of Labor

—12:30 P.M.—

I. COMMITTEE ON CENSUS ENUMERATION AREAS
Chairman: Howard Whipple Green, Cleveland Health Council
II. COMMITTEE ON SOCIOMETRICS
Chairman: George A. Lundberg, Bennington College

—2:30 P.M.—

I. CONTRIBUTIONS TO STATISTICAL TECHNIQUE
(With Institute of Mathematical Statistics)
Chairman: A. R. Crathorne, University of Illinois

Intra-sampling Theory
Harry C. Carver, University of Michigan

Efficient Measures of Relative Dispersion
Nilan Norris, University of Maryland

Correlation Functions in the Correlation Analysis of Time Series
Herbert E. Jones, Cowles Commission for Research in Economics

Contribution to the Theory of Multivariate Statistical Analysis
William G. Madow, Columbia University

A New Form of Periodogram Analysis and Comparison with Previous Forms (Read by title)
Dinsmore Alter, Griffith Observatory

A General Invariant Criterion of Fit for Lines, Planes, and Series Expansion Where All Variants Are Subject to Error
Charles F. Roos, Colorado College

Use of Scores in an Exact Test of Significance in a Discontinuous Distribution
H. W. Norton III, Iowa State College

On the Analysis of Variation in General Death Rates
Arthur Ollivier, Mississippi State College

II. STATISTICS AND MARKETING PROBLEMS
(With National Association of Marketing Teachers)
Chairman: Albert Haring, Lehigh University

Statistical Methods from Other Fields Which Can Be Adapted to Market Studies
Theodore H. Brown, Harvard University

MONDAY, DECEMBER 28, 1936

—2:30 P.M.—

II. STATISTICS AND MARKETING PROBLEMS (*Continued*)

Highlights of the 1935 Census of Distribution
Fred A. Gosnell, U. S. Census of Distribution

Improved Objective Standards for Regional Sales Performance
Donald R. G. Cowan, Swift and Company, Chicago

Uses of Distribution Census Material in Marketing Studies
Vergil Reed, Bureau of the Census

III. USE OF STATISTICS IN INDUSTRIAL CORPORATION REPORTS
Chairman: F. Leslie Hayford, General Motors Corporation

Corporation Statements as the Basis of Investment Policy
Laurence H. Sloan, Standard Statistics Company, New York City

Some Inadequacies in Corporation Reports and Suggested Remedies
Alexander Sachs, The Lehman Corporation, New York City
Discussion: Clyde J. Crobaugh, The Survey Corporation
Ragnar D. Naess, Goldman, Sachs and Company, New York City

IV. RESEARCH IN BUSINESS CYCLES
(With American Economic Association)
Chairman: W. L. Crum, Harvard University

Progress Report of the American Statistical Association Committee to Appraise the Statistical Evidence of the Causes of the 1929–32 Business Collapse
Willford I. King, New York University

Questions Raised by the Recent Business Collapse and Recovery
Joseph B. Hubbard, Harvard Business School

The Notions of "Economic System" Underlying Business Cycle Analysis
Karl Pribram, The Brookings Institution

Business Cycle Theories and Their Factual Verification
G. Haberler, Harvard University

A Study of Recent Business Experience
Norman J. Silberling, Stanford University
Discussion: Irving Fisher, Yale University
Alvin H. Hansen, University of Minnesota

—8:00 P.M.—

I. PROBLEMS OF MANAGED CURRENCIES
(With American Economic Association)
Chairman: W. Randolph Burgess, Federal Reserve Bank of New York

The Situation of Gold Today in Relation to World Currencies
Alvin H. Hansen, University of Minnesota

The Existing Mechanisms and Objectives for the Control of Exchange
Bertil Ohlin, Handelshogskolen, Stockholm

The Adequacy of Existing Currency Mechanisms under Varying Circumstances
John H. Williams, Harvard University

MONDAY, DECEMBER 28, 1936

—8:00 P.M.—

II. METHODS OF MEASURING CULTURAL VARIABLES
(With American Sociological Society)
Chairman: George A. Lundberg, Bennington College

A Quantitative Analysis of Cultural Diffusion in the United States
R. V. Bowers, University of Rochester

Consistency of Recording Statistical Data From Prison Files
Barkev S. Sanders, Department of Justice

Methods of Studying the Social Effects of the Depression
Samuel A. Stouffer, University of Chicago
Discussion: H. Earl Pemberton, Social Security Board

III. ROUND TABLE ON VITAL STATISTICS
Chairman: Lowell J. Reed, Johns Hopkins University
A discussion of the problems involved in the intercorrelation of official vital statistics and the results of the 1940 population census, with the object of making the joint study of these two bodies of material as productive as possible.

IV. MEASUREMENT OF PUBLIC OPINION
Chairman: Harwood L. Childs, Princeton University
George B. Gallup and Harold H. Anderson, American Institute of Public Opinion
W. L. Crum, Harvard University
Louis H. Bean, U. S. Department of Agriculture

TUESDAY, DECEMBER 29, 1936

—9:00 A.M.—

ANNUAL BUSINESS MEETING
Proposed Amendments to Constitution and By-Laws
Reports of Committees and Representatives

—10:00 A.M.—

I. SELECTED TOPICS IN STATISTICAL ECONOMICS
(With American Economic Association)
Chairman: Henry Schultz, University of Chicago

A Theory of Loss Leaders
Theodore O. Yntema, University of Chicago

Relation of Price to Quality and to Degree of Competition
Roswell H. Whitman, R. H. Macy & Company, New York City

Short Selling and the Stabilization of Stock Prices
Harry Pelle Hartkemeier, University of Missouri
Discussion: A. J. Nichol, University of Maryland
Francis E. McIntyre, Stanford University
Garfield V. Cox, University of Chicago

TUESDAY, DECEMBER 29, 1936

—10:00 A.M.—

II. STATISTICAL PROBLEMS IN SAMPLE ENUMERATIONS
(With American Farm Economic Association)
Chairman: G. F. Warren, Cornell University

Considerations in the Selection of Areas for Sample Agricultural Enumerations
J. B. Shepard and H. H. Schutz, Bureau of Agricultural Economics

Methods and Problems of Sampling Presented by the Study of Family Expenditures
Erika H. Schoenberg, National Resources Committee, and
Mildred Parten, Bureau of Labor Statistics
Discussion: Alexander Sturges, Bureau of Agricultural Economics
Zellmer R. Pettet, Bureau of the Census
J. I. Falconer, Ohio State University
Calvert L. Dedrick, Bureau of the Census

III. OLD AGE INSURANCE
(With American Association for Labor Legislation)
Chairman: Meredith B. Givens, New York Department of Labor

Comparison of the British and American Systems
J. Douglas Brown, Princeton University

The Problem of Reserves and a Possible Solution
M. Albert Linton, Provident Mutual Life Insurance Company, Philadelphia
Discussion: Edwin E. Witte, University of Wisconsin
Russell R. Reagh, U. S. Department of the Treasury

IV. SOME SOCIAL TRENDS
(With American Sociological Society)
Chairman: Neva R. Deardorff, Welfare Council of New York City

Population Characteristics Associated with Educational Levels in Chicago
Richard O. Lang, Central Statistical Board

Trends in Population Movements in Sweden
Dorothy S. Thomas, Yale University

Trends in Women's Work Since 1900
Chase G. Woodhouse, Connecticut College for Women
Discussion: Frank Lorimer, Population Association of America
Mildred Fairchild, Bryn Mawr College

V. PROBLEMS OF MANAGED CURRENCIES
(With American Economic Association. Invitational round table for discussion of previous papers.)
Chairman: James W. Bell, Northwestern University

TUESDAY, DECEMBER 29, 1936

—12:30 P.M.—

LUNCHEON MEETING

Chapter Representatives and Directors of the American Statistical Association

—2:30 P.M.—

I. IMPROVEMENT OF PERSONNEL IN THE TECHNICAL SERVICES OF THE FEDERAL GOVERNMENT

(With American Economic Association and American Farm Economic Association)

Chairman: Morris A. Copeland, Central Statistical Board

A Critique of Federal Personnel Policy as Applied to Professional Social Science Positions
William E. Mosher, Syracuse University

New Opportunities for Economists and Statisticians in Federal Employment
Leonard D. White, Civil Service Commission

Government Employment as a Professional Research Career in Economics
Isador Lubin, Bureau of Labor Statistics

II. LOGICAL VERSUS EMPIRICAL EQUATIONS IN THE SOCIAL AND BIOLOGICAL SCIENCES

Chairman: Herbert A. Toops, Ohio State University

The Logic of Empirical Equations
George W. Snedecor, Iowa State College

Physico-Mathematical Methods in Biological and Social Sciences
N. Rashevsky, University of Chicago

The Use of the Logical Equation in Epidemic Theory
Lowell J. Reed, The Johns Hopkins University

Some Aspects of the Deductive and Empirical Methods in Economics
Theodore O. Yntema, University of Chicago

III. MEASUREMENT OF COMPONENTS OF THE NATIONAL INCOME

(With Conference on Income Research)

Chairman: Alvin H. Hansen, University of Minnesota

Problems of Measurement of Labor Income
Solomon Kuznets, Bureau of Labor Statistics

Problems in the Measurement of Relative Purchasing Power of Net Farm and Net Urban Income
O. C. Stine, Bureau of Agricultural Economics

Discussion: Leo Wolman, Columbia University
Murray W. Latimer, Railroad Retirement Board
John D. Black, Harvard University
Murray R. Benedict, University of California

TUESDAY, DECEMBER 29, 1936

—2:30 P.M.—

IV. INDICIA OF RECOVERY
(With American Economic Association)
Chairman: Willford I. King, New York University

Indicia of Recovery for the United States
Ernest S. Griffith, American University

Regional Barometers of Recovery
L. D. H. Weld, McCann-Erickson Inc., New York City

Indicia of Recovery for England
Thomas Ballough, University of London

Indicia of Recovery for Sweden
James D. Magee, New York University

—5:00 P.M.—

SECTION COMMITTEE MEETING
Committee on Biometrics and Vital Statistics

—6:00 P.M.—

DINNER MEETING OF FELLOWS OF THE AMERICAN STATISTICAL ASSOCIATION
Chairman: Joseph S. Davis, Food Research Institute

Introduction of Newly-Elected Fellows
W. L. Crum, Harvard University

The Association and the Statistical Profession
Edmund E. Day, The Rockefeller Foundation

—8:00 P.M.—

PRESIDENTIAL ADDRESSES
Chairman: Walter F. Willcox, Cornell University

Statistics and Social Engineering
Joseph S. Davis, American Statistical Association

The Political Interpretation of History
Arthur N. Holcombe, American Political Science Association

Business as an Institution
Henry Fairchild, American Sociological Society

The Interstate Commerce Worker and Social Security
Joseph P. Chamberlain, American Association for Labor Legislation

The Economist in a World of Transition
Alvin S. Johnson, American Economic Association

WEDNESDAY, DECEMBER 30, 1936

—9:00 A.M.—

ANNUAL BUSINESS MEETING
Election of Officers

—10:00 A.M.—

I. NON-TECHNICAL EXPOSITORY PAPERS ON MATHEMATICAL STATISTICS
(With the Institute of Mathematical Statistics)
Chairman: Henry L. Rietz, University of Iowa

Recent Advances in Mathematical Statistics
Paul R. Rider, Washington University

The Analysis of Sets of Correlated Variates
Harold Hotelling, Columbia University
Discussion: Allen T. Craig, University of Iowa
S. S. Wilks, Princeton University

II. INVESTIGATIONS OF FAMILY EXPENDITURES
Chairman: Horatio M. Pollock, New York State Department of Mental Hygiene

Methods of Analyzing Families by Type with Respect to Consumption
Day Monroe, Bureau of Home Economics

The Measurement of Variations in Family Expenditures
Faith M. Williams, Bureau of Labor Statistics
Discussion: Hazel Kyrk, University of Chicago

III. SELECTED PAPERS
Chairman: Aryness Joy, Central Statistical Board

A Statistical Study of Average and Marginal Cost
Joel P. Dean, Indiana University

Methods Used in Strike Statistics
Florence Peterson, Bureau of Labor Statistics

A Balance Sheet of the Nation's Economy
Frank G. Dickinson, University of Illinois, and
Franzy Eakin, A. E. Staley Manufacturing Company

IV. VITAL STATISTICS
Chairman: Halbert L. Dunn, Bureau of the Census

An Application of Sampling Principles to the Theory of Simple Epidemics
Lowell J. Reed, The Johns Hopkins University

Effect of Residence Allocation on Death Rates
Forrest E. Linder, Bureau of the Census

The Intraindividual and Interindividual Variability of the Basal Metabolism in Normal Subjects
Joseph Berkson, Mayo Clinic

A Syphilis Morbidity Survey in New York State
G. H. Ramsey and Jacob Yerushalmy, New York State Department of Health

WEDNESDAY, DECEMBER 30, 1936

—10:00 A.M.—

V. CONFERENCE ON RELIEF STATISTICS

(Open Meeting of Joint Committee on Relief Statistics of American Public Welfare Association and American Statistical Association)

Chairman: Howard B. Myers, Works Progress Administration

—12:30 P.M.—

BOARD OF DIRECTORS

—2:30 P.M.—

I. RESEARCH ON CAUSES OF VARIATIONS IN FERTILITY

(With Population Association of America)

Chairman: P. K. Whelpton, Scripps Foundation for Population Research

Medical Aspects

Regine Stix, Milbank Memorial Fund

Economic Aspects

Faith M. Williams, Bureau of Labor Statistics

Social-Psychological Aspects

Leonard S. Cottrell, Jr., Cornell University

Demographic Aspects

Harold F. Dorn, U. S. Public Health Service

II. FOREIGN TRADE AND INTERNATIONAL PAYMENTS

Chairman: Donald M. Marvin, Royal Bank of Canada

The Problem of Measuring the Effects of Reciprocal Trade Agreements

E. Dana Durand, U. S. Tariff Commission

Statistical Methods in Balance of Payments Estimates

Amos E. Taylor, Bureau of Foreign and Domestic Commerce

Discussion: Henry Chalmers, Bureau of Foreign and Domestic Commerce
Joseph B. Hubbard, Harvard Business School
Emile Despres, Federal Reserve Bank of New York
Frank W. Fetter, Haverford College

III. PROGRAMS FOR THE STUDY OF COSTS AND PRICES IN AMERICAN INDUSTRIES

(Round Table with Conference on Price Research)

Chairman: Frederick C. Mills, Columbia University

Price Research in Textiles

(Report prepared by a committee of the Conference on Price Research, under the chairmanship of S. J. Kennedy)

Price Research in Steel

(Report prepared by a committee of the Conference on Price Research, under the chairmanship of Samuel S. Stratton)

Discussion: H. S. Davis, University of Pennsylvania
Ralph J. Watkins, University of Pittsburgh
Malcolm Sharp, University of Chicago
Willard L. Thorp, Dun and Bradstreet

WEDNESDAY, DECEMBER 30, 1936

—2:30 P.M.—

IV. STATISTICAL METHODS FOR EXPERIMENTAL DATA

Chairman: George W. Snedecor, Iowa State College

An Experiment Planned with Confounding in Incomplete Blocks

W. J. Youden, Boyce Thompson Institute for Plant Research

Correlation Between Mean and Standard Deviation in Field Experiments

F. R. Immer, University of Minnesota

The Efficiency in Field Trials of Pseudo-Factorial and Incomplete Randomized Block Methods

C. H. Goulden, Dominion Rust Research Laboratory and Manitoba College of Agriculture

The Analysis of Variance and Covariance in Non-orthogonal Data

S. S. Wilks, Princeton University

V. ROUND TABLE ON UNEMPLOYMENT

(Invitational discussion group)

Chairman: Ewan Clague, Social Security Board

—6:00 P.M.—

DINNER MEETING: RETROSPECT AND PROSPECT

(Joint meeting with the Chicago Chapter of the American Statistical Association)

Chairman: Joseph S. Davis, President, American Statistical Association

Outlook for 1937

F. Leslie Hayford, General Motors Corporation

Prospect for 1937–41

Leonard P. Ayres, Cleveland Trust Company

MINUTES OF THE ANNUAL BUSINESS MEETING

The American Statistical Association convened for the annual business meeting at 9:00 A.M. on Tuesday, December 29, 1936, at the Stevens Hotel in Chicago. President Joseph S. Davis presided.

Reports were received from the following committees and representatives: the Joint Advisory Committee on the Census, the Committee on Census Enumeration Areas, the Joint Committee on Income Tax Statistics, the Committee on Statistics of Institutions for Mental and Physical Disorders, the Committee to Appraise the Statistical Evidence of the Causes of the 1929–1932 Business Collapse, the Committee on Relief Statistics, the Representative on the Business Research Council, the Representative on the Joint Committee for the Development of Statistical Applications in Engineering and Manufacturing, the Representative on the National Conference on Nomenclature of Disease, and the Representative on the Sectional Committee on Standards for Graphic Presentation.[1]

It was voted to approve for adoption at the next Annual Meeting a series of amendments to the Constitution of the Association which, when adopted, will make the Constitution read as follows:

CONSTITUTION

Article I—Name

This Association shall be denominated the American Statistical Association.

Article II—Objects

The objects of the Association shall be to collect, preserve, and diffuse statistical information in the different departments of human knowledge. To this end it is part of the purpose of this Association to conduct meetings and publish scientific papers, to promote the improvement of statistical data and technique, to foster contacts among persons seriously concerned with statistical information, problems, and methods, with a view to stimulating research and elevating the standards of statistical work, and to encourage the application of statistical science to practical affairs.

Article III—Membership

The membership of the Association shall consist of Regular Members, Fellows, Honorary Members, and Corporate Members.

Regular Members shall be persons interested in the objects of the Association, elected by vote of the Board of Directors, on nomination of one or more members.

Fellows shall be statisticians of established reputation, elected by unanimous vote of the Committee on Fellows as provided in Article IV. The number of Fellows shall not exceed one hundred and fifty at any time.

Persons distinguished in the field of statistics or of public service may be elected to honorary membership by unanimous vote of the Board of Directors.

Corporations and other organizations interested in the objects of the Association may be admitted to corporate membership by vote of the Board of Directors.

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[1] See pp. 202–216.

Article IV—Committee on Fellows

There shall be a Committee on Fellows which shall survey the membership roll once each year and announce its election of Fellows, if any, at the Annual Meeting of the Association. The Committee on Fellows shall consist of five Fellows, one of whom shall be appointed by the retiring President at each Annual Meeting for a term of five years. Appointments to fill unexpired terms shall be made by the President as such vacancies occur. No Fellow may serve on the Committee for two full terms in immediate succession. The senior member of the Committee, in respect of continuous service, shall serve as its Chairman.

Article V—Officers

The officers of the Association shall be a President, a number of Vice-Presidents, a Secretary, a Treasurer, and an Editor. The duties of the officers shall be those usually devolving upon such officers except as may be otherwise provided by the By-Laws.

Each of the Vice-Presidents shall represent a distinct field of statistical interest. The number and fields of interest of the several Vice-Presidential offices shall be fixed in accord with the provisions of the By-Laws. The Vice-Presidents shall advise the President and Secretary in the preparation for annual and special meetings and in other matters concerning the interests of the groups they respectively represent in the membership of the Association. In case of the incapacity of the President to perform the duties of his office on any occasion, the Secretary shall designate which of the Vice-Presidents shall act as President.

Article VI—Board of Directors

There shall be a Board of Directors for the government of the Association consisting of the President, the Secretary and six elected Directors. The Secretary shall call a meeting of the Board of Directors on request of the President or any three Directors and shall notify the Directors of such meeting at least seven days in advance. Three Directors shall constitute a quorum at any meeting regularly convened.

Article VII—Elections

The officers of the Association other than the Editor shall be elected each year at the Annual Meeting and shall serve until the close of the Annual Meeting at which their successors are elected. The Editor shall be appointed by the Board of Directors. The six elected Directors shall be elected for terms of three years each, two of which terms shall expire at the close of each Annual Meeting. No elected Director may serve two terms in immediate succession. The Board of Directors shall fill vacancies in any office and in its own membership until the next Annual Meeting.

The President shall appoint a Nominating Committee of three members, the personnel of which shall be announced to the membership at least three months before the Annual Meeting. At least thirty days before the Annual Meeting the Nominating Committee shall report to the membership its nominations of Officers and Directors to be elected at the next Annual Meeting.

Twelve or more Regular Members or Fellows may make nominations for any office by submitting a signed petition to the Secretary of the Association not less than twenty-four hours before the beginning of the business meeting at which the election is scheduled to take place. In case a nomination by petition is made, the

Nominating Committee may present to the Annual Meeting the names of one or more additional nominees for the same office.

When but one person has been nominated for a given office, that person may be elected at the Annual Meeting by a *viva voce* vote. If there are two or more nominations for the same office, it shall be the duty of the Secretary to announce such nominations. In the latter case, the election for this office shall be by secret ballot, and the President shall appoint three judges of election who shall count the ballots. The judges of election shall decide any questions that may arise as to the validity of any ballot, and shall declare the results of the election. The candidate who receives a plurality of the votes cast for that office shall be declared elected. The President shall vote only in case of a tie vote, in which event he shall cast the decisive ballot.

Article VIII—Meetings

Annual and occasional meetings of the Association shall be held at such times and places as the Board of Directors may designate. The President shall have direct charge of the general program of such meetings with the assistance and advice of the Vice-Presidents and Secretary.

Article IX—Sections

The Board of Directors may establish a Section for any field or fields of statistical specialization when such action promises to advance the objects of the Association. For each Section there shall be a Section Committee appointed by the Board of Directors or elected by the members affiliated with the Section as the Board of Directors may determine. Regular Members and Fellows may affiliate themselves with one or more Sections under regulations established by the Board of Directors. Each Section shall be empowered to engage in such activities as the Board of Directors may authorize. The Board of Directors may combine, divide, or dissolve Sections, or revise their respective fields, whenever such action is recommended by the Section Committee or Committees involved or by the members at an Annual Meeting.

Article X—Chapters

The Board of Directors may establish a Chapter of the Association in any city or geographic district when such action promises to advance the objects of the Association. The Board of Directors shall formulate requirements concerning chapters. It may dissolve any Chapter when such action appears to be in the interest of the Association.

Article XI—Resolutions

No resolution requesting, advocating, commending, or condemning any action or proposed action, not arising out of the activities of the Association, shall be submitted to the Association for a vote unless the resolution shall first have been approved by the Board of Directors of the Association.

Article XII—Amendments

Amendments to this Constitution may be proposed by any member of the Association at the Annual Meeting, and if supported by at least one-third of the members present and voting shall be submitted to the next Annual Meeting, where a two-thirds vote of all members present and voting shall be required for adoption.

Amendments to the By-Laws of the Association were adopted making the By-Laws read as follows:

BY-LAWS

1. At least one month in advance of each Annual Meeting the Secretary shall mail to each member of the Association a notice of the time, place and program of the meeting. At suitable intervals the Secretary shall publish the Constitution and By-Laws and a membership roll. A copy shall be supplied to each member.

2. Regular Members and Fellows shall pay annual dues of $5.00 payable at the beginning of the calendar year. Regular Members and Fellows who choose to pay $25.00 or more in any year shall be designated as Contributing Members. Corporate Members shall pay dues of $100.00 per annum payable at the beginning of the period covered.

If two members are husband and wife, one of them may elect to pay annual dues of $2.00 in which case he shall not receive the publications and notices which are sent to other members.

Upon the written request of any Regular Member or Fellow and the payment of $100.00, the Board of Directors may designate such Regular Member or Fellow as a Life Member without altering his previous status except to exempt him from payment of annual dues.

Honorary Members shall not be required to pay annual dues. The Board of Directors may, in its discretion, exempt a Regular Member or Fellow from the payment of annual dues for such a period as it designates.

3. Each Corporate Member may designate two representatives. In addition to their status as Corporate Representatives, persons so appointed shall enjoy all the rights and privileges of individual members. Corporate Representatives shall not be required to pay annual dues.

4. No resolution requesting, advocating, commending, or condemning any action or proposed action, not arising out of the activities of the Association, shall be submitted to the Association for a vote unless the resolution shall first have been approved by the Board of Directors of the Association.[2]

5. All funds of the Association shall be deposited with the Treasurer and disbursements therefrom shall be made by the Treasurer under such regulations as the Board of Directors may establish.

There shall be a Committee on Investments composed of three to five Regular Members or Fellows appointed by the Board of Directors to supervise the investment and reinvestment of such funds as the Board of Directors may designate. The Treasurer shall have authority to purchase securities with the funds that the Board of Directors has designated for investment, and to sell such securities, but such purchases and sales shall be made only on the written order of the majority of the Committee on Investments signed by two members of the Committee.

The fiscal year shall be the calendar year. The Treasurer shall make a detailed financial report to the Board of Directors within thirty days after the end of each fiscal year. The Treasurer's report shall be audited by an Auditing Committee appointed by the President before the expiration of his term of office. The report of the Auditing Committee shall be published with the Treasurer's report in the *Journal.*

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[2] When these amendments were presented it was pointed out that upon the adoption of the amendments to the Constitution, a By-Law specifying the fields of interest to be represented by the Vice-Presidents should be substituted for By-Law 4.

6. The Association shall publish a journal under the title *Journal of the American Statistical Association* and such other publications as may be useful in advancing the objects of the Association. The Board of Directors shall appoint five Associate Editors to aid the Editor in editing the *Journal.*

7. Except as otherwise specified by the Constitution and By-Laws or action of the Board of Directors, all committee appointments shall terminate on March 31 of each year.

8. The Board of Directors may appoint one or more District Representatives to promote the objects of the Association in designated geographic districts or regions.

9. These By-Laws may be amended at any Annual Meeting of the Association by a two-thirds vote of the members present and voting.

Walter F. Willcox, presenting the report of the committee to arrange for a meeting of the International Statistical Institute in the United States in 1939 at the time of the centenary meeting of the American Statistical Association, stated that the Federal Government's invitation had been extended at the recent Athens meeting of the Institute by the U. S. Minister to Greece and gladly accepted. He also expressed the hope that arrangements could be made for a centennial history of the American Statistical Association, which might perhaps be enlarged to cover the history of Federal statistics for the 150 years of its history. It was voted to authorize the Board of Directors until the next annual meeting to act upon this proposal.

The business meeting was adjourned until 9:00 A.M., December 30, 1936.

The business meeting was resumed at 9:00 A.M., December 30, 1936, in the Stevens Hotel in Chicago. Vice-President F. Leslie Hayford presided.

The reports of the Secretary-Treasurer were presented in preliminary form subject to minor revisions at the end of the fiscal year. The Editor's report was presented.

The report of the Committee on Nominations was presented as follows:

President: W. RANDOLPH BURGESS

Vice-Presidents:

Collection and Classification of Data and Administration of Statistical Agencies

FAITH M. WILLIAMS

Statistical and Actuarial Methods and Technique, and the Teaching of Statistics

BURTON H. CAMP

Facts and Methods Pertaining to Political Science, Sociology, Social Welfare Problems, and Vital Statistics

SAMUEL A. STOUFFER

Facts and Methods Related to Anthropology, Biometry, Psychology, and Education

HALBERT L. DUNN

Facts and Methods Bearing upon Economics and Economic Theory
ALVIN H. HANSEN
Facts and Methods Pertaining Primarily to Business
DONALD R. BELCHER
Facts and Methods Pertaining to Financial Institutions
CASIMIR A. SIENKIEWICZ
Facts and Methods Pertaining to Marketing
JOHN H. COVER

Directors: (For terms expiring at the close of the Annual Meeting in 1939.)
MORRIS A. COPELAND
JOSEPH S. DAVIS

Secretary-Treasurer: FREDERICK F. STEPHAN
Editor of the Journal: FREDERICK F. STEPHAN

The Secretary was instructed to cast one ballot for the candidates nominated. The ballot was cast and the nominees were duly elected.

W. L. Crum reported that the Committee on Fellows had elected the following Fellows: Burton H. Camp, Morris A. Copeland, and Paul R. Rider.

Reports were received from the following committees and representatives: the Committee on Labor Statistics, the Committee on an Annual Review of Progress in Mathematical Statistics, the Committee on Sociometrics, the Committee to Stimulate and Coordinate Research, the Representative on the Board of Directors of the National Bureau of Economic Research, the Representative on the Conference on National Income and Wealth, and the Representatives on the Social Science Research Council.[3]

The following resolutions were adopted:

> RESOLVED that the members of the American Statistical Association deeply appreciate the leadership that President Joseph S. Davis has given them during 1936 and record a very hearty vote of thanks to him, and to the Vice-Presidents who assisted him, for the very excellent program of this Annual Meeting.
>
> RESOLVED that the American Statistical Association expresses its gratitude and appreciation to Dr. Donald R. G. Cowan, its Representative on the Joint Committee on Local Arrangements, and to Professor Garfield V. Çox, Chairman of that Committee, for their great services in making the local arrangements essential to the success of this Annual Meeting.
>
> RESOLVED that the American Statistical Association warmly thanks the management and employees of the Stevens Hotel for the comfort and care that the members of the Association have enjoyed at this Annual Meeting.

The meeting was adjourned.

FREDERICK F. STEPHAN, *Secretary*

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[3] See pp. 205–216.

REPORT OF THE SECRETARY

During 1936 the Secretary's office has continued to extend the activities mentioned in the report for 1935 and has assisted the officers and committees in their work. A *Bulletin* was developed on an experimental basis in order to provide a medium for various notices and communications and for informal discussion by members of professional problems and Association affairs. This *Bulletin* is not yet filling the place that it is intended to fill, but substantial progress has been made toward that goal.

The year was a very successful one for the Chapters. Their interesting meetings are reported in a special section in each issue of the JOURNAL. There were 54 Chapter meetings during the year. Representatives from ten Chapters met with the Board of Directors at the Annual Meeting in Chicago for a discussion of Chapter programs and the relationship of the Association to its Chapters.

The membership of the Association increased during the year by 124 members. In 1936, 216 new members were elected and 27 former members were reinstated. Seventy-eight members were removed from the membership list for failure to pay their dues of whom 23 were reinstated before the end of the year. Fifty-four members were lost by resignation and ten by death. At the end of the year the Board of Directors had approved 21 applications for membership to begin January 1, 1937.

The following deaths were recorded during the year: Honorary Members, Karl Pearson and Harold Ludwig Westergaard; Fellows, John Cummings, Malcolm C. Rorty, I. M. Rubinow, and Edgar Sydenstricker; and Regular Members Florence DuBois, Harkness G. Hard, Richard Wallace Schabacker, and Caroline E. Wilson.

MEMBERSHIP STATEMENT, DECEMBER 31, 1936

Honorary members		19
Corporate members		5
Fellows:		
Contributing member	1	
Life members	8	
Other Fellows	77	86
Regular members:		
Life members	22	
Other regular members	1,743	1,765
Total membership		1,875

The number of subscribers increased from 521 at the end of 1935 to 536 at the end of 1936.

FREDERICK F. STEPHAN, *Secretary*

REPORT OF THE TREASURER

During 1936 there was a substantial increase in receipts from dues as a result of the growth in membership during the year. Expenditures for JOURNAL printing were reduced sharply because no Handbook was published in 1936 and because there was a reduction of more than $200 in orders from authors for reprints. Exclusive of the purchase and sale of securities, cash receipts exceeded cash expenditures by $1,311.35. However, at the end of the fiscal year there was an unpaid bill for travel expense amounting to $76.55 and the bill for the reprints for the December JOURNAL amounting to approximately $165.00 had not been received. Of this excess of receipts over expenditures $63.70 is carried forward as the balance in the special account for The Rockefeller Foundation grant.

Investments are shown on the balance sheet at market value at the end of the fiscal year with cost figures for comparative purposes. The latter figures include the cost of certain shares of stock acquired during 1892 and 1893, the market value of which on December 31, 1936, was approximately $1,000 less than cost. During the year approximately $3,300 was invested in addition to the proceeds of securities sold during the year.

Comparative balance sheets and a statement of receipts and expenditures are attached.

FREDERICK F. STEPHAN, *Treasurer*

AMERICAN STATISTICAL ASSOCIATION
COMPARISON OF BALANCE SHEETS

	December 31, 1935		December 31, 1936	
ASSETS				
Current Assets and Investments:				
Cash				
Checking account (American Security and Trust Company)	$1,994.35		$ 13.21	
Savings account (Emigrant Industrial Savings Bank)	359.44		366.66	
Petty cash	13.86	$ 2,367.65	0.00	$ 379.87
Investments		8,099.00*		13,874.25†
Receivables				
Accrued interest	$ 16.79		$ 26.83	
Accounts receivable	67.50		75.95	
Dues receivable, less doubtful items	150.00	234.29	100.00	202.78
Inventories				
Journal	$1,500.00		$1,500.00	
Special publications	35.00	1,535.00	35.00	1,535.00
Furniture and Equipment, less depreciation		648.18		575.05
Total assets		$12,884.12		$16,566.95
LIABILITIES AND SURPLUS				
Current Liabilities:				
Unearned income				
Dues	$ 795.91		$ 912.93	
Subscriptions	1,608.00		1,452.50	
Miscellaneous credits	29.33	$ 2,433.24	3.08	$ 2,368.51
Bills payable		0.00		76.55
Special account, The Rockefeller Foundation Grant		0.00		63.70
Life Memberships		1,980.00		2,030.00
Corporate Surplus		8,470.88		12,028.19
Total liabilities and surplus		$12,884.12		$16,566.95

* Market value, December 31, 1935. Cost $9,017.60.

† Market value, December 31, 1936. Cost $12,893.51.

AMERICAN STATISTICAL ASSOCIATION
STATEMENT OF RECEIPTS, EXPENDITURES, AND CASH BALANCES

December 31, 1935 to December 31, 1936

Cash on hand, December 31, 1935:		
Checking account (American Security and Trust Company)	$ 1,994.35	
Savings account (Emigrant Industrial Savings Bank)	359.44	
Petty Cash	13.86	$ 2,367.65
Net cash receipts, December 31, 1935 to December 31, 1936:		
General account	$19,381.79	
Special account: The Rockefeller Foundation Grant	7,500.00	26,881.79
Total		$29,249.44
Net cash expenditures, December 31, 1935 to December 31, 1936:		
General account	$21,433.27	
Special account: The Rockefeller Foundation Grant	7,436.30	$28,869.57
Cash on hand, December 31, 1936:		
Checking account (American Security and Trust Company)	$ 13.21	
Savings account (Emigrant Industrial Savings Bank)	366.66	379.87
Total		$29,249.44

AMERICAN STATISTICAL ASSOCIATION
STATEMENT OF CASH RECEIPTS AND EXPENDITURES

December 31, 1935 to December 31, 1936

	General Account	Special Account: The Rockefeller Foundation Grant	Total
Receipts:			
Dues	$ 9,646.92	—	$ 9,646.92
Subscriptions	3,039.29	—	3,039.29
Advertising	356.69	—	356.69
Reprints	232.30	—	232.30
Journal sales	245.80	—	245.80
Special publications	36.95	—	36.95
Dividends and interest	712.42	—	712.42
Other receipts	73.24	—	73.24
The Rockefeller Foundation Grant	—	$7,500.00	7,500.00
Total receipts, exclusive of sale of securities	$14,343.61	$7,500.00	$21,843.61
Sale of securities	5,038.18	—	5,038.18
Total receipts	$19,381.79	$7,500.00	$26,881.79
Expenditures:			
JOURNAL: Printing, mailing and reprints	$ 4,610.40	—	$ 4,610.40
Bulletin	158.81	$ 207.26	366.07
Salaries and wages	6,317.23	4,905 00	11,222.23
Rent	288.00	792.00	1,080.00
Office supplies, printing and mimeographing	722.62	170.85	893.47
General postage and carriage	439.27	65.00	504.27
Telephone and Telegraph	100.00	52.43	152.43
Travel expense: Officers	—	817.69	817.69
Travel expense: Committees	—	282.62	282.62
Furniture and equipment	28.35	—	28.35
Old JOURNALS purchased	42.08	—	42.08
Storage of old JOURNALS	125.62	—	125.62
Other expense	263.58	143.45	407.03
Total expenditures, exclusive of purchase of securities	$13,095.96	$7,436.30	$20,532.26
Purchase of securities	8,337.31	—	8,337.31
Total expenditures	$21,433.27	$7,436.30	$28,869.57

Report of the Auditing Committee

We have examined the balance sheet of the American Statistical Association as of December 31, 1936, verified the cash, and checked the securities on hand. We have also examined the statement of receipts and expenditures.

In our opinion the balance sheet is a correct statement of the financial condition of the Association and the receipts and expenditures statements are duly supported by accompanying vouchers.

Spurgeon Bell
D. C. Elliott

Report of the Editor

Volume 31 of the *Journal of the American Statistical Association* was published in 1936. The customary *Proceedings Supplement* was incorporated in the March issue. The number of pages devoted to the publication of papers delivered at the Annual Meeting was almost exactly equal to the average over the four preceding volumes, but a larger proportion of these papers was published in the June, September, and December numbers. The volume totaled 820 pages, 34 pages more than the preceding volume, exclusive of the 1935 *Handbook*. A considerably larger number of pages than usual was devoted to reviews.

The quality of the contents of the volume just completed is due to the efforts of the Review Editor, Ralph J. Watkins, to the authors of articles, the contributors of notes, the reviewers, and the many members who acted as editorial advisers.

Frederick F. Stephan, *Editor*

LIST OF COMMITTEES FOR 1936

RESEARCH COMMITTEES

Committee to Stimulate and Coordinate Research

Meredith B. Givens, *Chairman*
Morris A. Copeland
W. Leonard Crum
Neva R. Deardorff
Howard W. Green
Horatio M. Pollock
Paul R. Rider
Winfield W. Riefler
Thorsten Sellin
Casimir A. Sienkiewicz
Willard L. Thorp
Mary van Kleeck

(The President, *ex officio*, the Secretary and the Chairmen of all the Research Committees.)

Committee on Government Statistics and Information Services[1]

Frederick C. Mills, *Chairman*
M. B. Givens, *Executive Secretary*
Donald R. Belcher
Murray R. Benedict
William J. Carson
Robert E. Chaddock
Ewan Clague
J. Frederic Dewhurst
Bryce M. Stewart
Samuel A. Stouffer
Ralph J. Watkins

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[1] Continued on inactive status pending publication of report.

Committee on Census Enumeration Areas

Howard W. Green, *Chairman*
Clarence E. Batschelet
Robert E. Chaddock
Neva R. Deardorff
Calvert L. Dedrick
R. D. McKenzie
Leon Truesdell

Committee on Statistics of Delinquents and Criminals

Thorsten Sellin, *Chairman*
Morris Ploscowe, *Secretary*
Charles E. Clark
G. E. Gehlke
R. R. Lutz
Bennet Mead
Barkev S. Sanders
Edwin H. Sutherland
George Vold

Joint Committee on Income Tax Statistics (with American Economic Association)

W. L. Crum, *Chairman*
David Friday
Simon Kuznets

Committee on Industrial Statistics

Willard L. Thorp, *Chairman*
Charles A. Bliss
C. R. Chambers
Stephen M. DuBrul
Joseph B. Hubbard
Leonard Kuvin
Howard H. McClure
Claudius Murchison

Committee on Labor Statistics

Casimir A. Sienkiewicz, *Chairman*
Ewan Clague
Carroll R. Daugherty
O. A. Fried
Meredith B. Givens
Gladys L. Palmer
Eugene B. Patton
William H. Stead
Sidney W. Wilcox

Committee on Statistics of Institutions for Mental and Physical Disorders

Horatio M. Pollock, *Chairman*
G. W. Baehne
Frederick W. Brown
Kate H. Claghorn
Mary Augusta Clark
Emil Frankel
Carl E. McCombs
David M. Schneider

Committee on Statistics of Relief and Child Care[2]

Neva R. Deardorff, *Chairman*
F. Stuart Chapin
Emil Frankel
Ralph G. Hurlin
Maurice J. Karpf
Philip Klein
David M. Schneider
Maude E. Stearns
Emma Winslow
Helen Witmer

[2] Continued as two committees: the Committee on Relief Statistics and the Committee on Statistics of Dependent Children in Foster Care.

Committee on Relief Statistics[3]

Ralph G. Hurlin, *Chairman*
Neva R. Deardorff
Frederick F. Stephan
Paul Webbink

Committee on Statistics of Dependent Children in Foster Care

Neva R. Deardorff, *Chairman*

OTHER COMMITTEES AND REPRESENTATIVES

Committee on Fellows

W. L. Crum (*For the term expiring December 31, 1936*)
William F. Ogburn (*For the term expiring December 31, 1937*)
Emanuel A. Goldenweiser (*For the term expiring December 31, 1938*)
E. Dana Durand (*For the term expiring December 31, 1939*)
Walter A. Shewhart (*For the term expiring December 31, 1940*)

Committee on Nominations

Robert E. Chaddock, *Chairman*
Leonard P. Ayres
Meredith B. Givens

Committee on Finance

Frederick R. Macaulay, *Chairman*
Willford I. King
Dean Langmuir

Committee on Association Policy

Joseph S. Davis
Frederick C. Mills
Frederick F. Stephan

Committee to Arrange for a Meeting of the International Statistical Institute in the United States in 1939

Walter F. Willcox, *Chairman*
E. Dana Durand
Haven Emerson
Stuart A. Rice
(The President and Secretary, *ex officio*)

Committee to Appraise the Statistical Evidence of the Causes of the 1929–1932 Business Collapse

W. I. King, *Chairman*
Seymour L. Andrew
Leonard P. Ayres
William A. Berridge
Robert W. Burgess
Paul T. Cherington
John H. Cover
Garfield V. Cox
Carroll W. Doten
George J. Eberle
J. F. Ebersole
Ralph C. Epstein
Alfred T. Falk
Irving Fisher
F. Leslie Hayford
Stanley B. Hunt
Harry Jerome
Edwin W. Kemmerer
Wesley C. Mitchell
Otto Nathan
Frank A. Pearson
Horatio M. Pollock
John R. Riggleman
George B. Roberts
Norman J. Silberling
Laurence H. Sloan
Bradford B. Smith
Carl Snyder
Ralph J. Watkins
Ray B. Westerfield
Edwin B. Wilson
Leo Wolman

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[3] Authorised to act with the Committee on Statistical Forms and Procedures of the American Public Welfare Association as a Joint Committee on Relief Statistics.

Committee on Biometrics and Vital Statistics

Lowell J. Reed, *Chairman*
Joseph Berkson
Robert E. Chaddock
Selwyn D. Collins
John Collinson
J. V. DePorte
Harry H. Laughlin
Alfred J. Lotka
Hugo Muench, Jr.
Richard E. Scammon
Edgar Sydenstricker[4]

Committee on Sociometrics

George A. Lundberg, *Chairman*
F. Stuart Chapin
Calvert L. Dedrick
Stuart A. Rice
Samuel A. Stouffer
Dorothy S. Thomas
George B. Vold

Committee on Special Publications

Frederick F. Stephan, *Chairman*
Meredith B. Givens
Paul R. Rider
Frank A. Ross

State Committee for Pennsylvania

Ewan Clague, *Chairman*
William J. Carson
Casimir A. Sienkiewicz

Committee on an Annual Review of Progress in Mathematical Statistics

Paul R. Rider, *Chairman*
Burton H. Camp
Samuel S. Wilks

Representative on the Board of Directors of the National Bureau of Economic Research

Winfield W. Riefler

Representatives on the Joint Advisory Committee on the Census

Willford I. King (*For the term expiring December 31, 1936*)
Paul T. Cherington (*For the term expiring December 31, 1937*)
Robert E. Chaddock (*For the term expiring December 31, 1938*)

Members of the Social Science Research Council

Seymour L. Andrew (*For the term expiring December 31, 1936*)
Edwin B. Wilson (*For the term expiring December 31, 1937*)
William A. Berridge (*For the term expiring December 31, 1938*)

Representative on the Council of the American Association for the Advancement of Science

William F. Ogburn

Representative on the Business Research Council

Donald R. Belcher

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[4] Deceased.

Representative on the National Conference on Nomenclature of Disease
George H. Van Buren

Representative on the Joint Committee for the Development of Statistical Applications in Engineering and Manufacturing
Walter A. Shewhart

Representative on the Sectional Committee on Standards for Graphic Presentation
A. H. Richardson

Representative on the Conference on National Wealth and Income
Aryness Joy

REPORTS OF COMMITTEES AND REPRESENTATIVES

REPORT OF THE COMMITTEE ON FELLOWS

The Committee on Fellows has elected by unanimous vote the following Fellows: Burton H. Camp, Morris A. Copeland, and Paul R. Rider.

W. L. CRUM
WILLIAM F. OGBURN
EMANUEL A. GOLDENWEISER
E. DANA DURAND
WALTER A. SHEWHART

REPORT OF THE JOINT ADVISORY COMMITTEE ON THE CENSUS

The only meeting of the Joint Census Advisory Committee in the year 1936, was held at Washington on November 13 and 14. All members of the Committee were present with the exception of W. F. Ogburn, who had been appointed to fill the vacancy created by the resignation of E. E. Day, but was in Europe at the time of this meeting. R. E. Chaddock was elected temporary chairman.

The first day of the meeting was devoted mainly to acquainting the Committee with the progress and condition of work in the various divisions of the Bureau. This included a visit to the machine shop and an opportunity to see the latest improvements in the Bureau's tabulating and photostating equipment.

Of special interest to the Committee was the report of what had been done in regard to estimating population. It will be remembered that at the last previous meeting of the Committee, held in November, 1935, a resolution was adopted recommending that the Bureau should continue to accept the responsibility for making estimates covering individual cities having 10,000 or more inhabitants, counties or groups of counties, the rural population of states, and the population of cities of 2,500 to 10,000 in each state as a group—recommendations which closely followed those previously adopted by the Special Advisory Committee on Vital Statistics in conference with representatives of the Population Association of America. It is generally recognized that the methods of estimating formerly used can no longer be applied. For the country as a whole satisfactory estimates can be made on the basis of registered births and deaths and immigration data; and fairly satisfactory estimates for states have been made based mainly on school enrollment figures. Some progress was being made on estimating for cities when the work was interrupted by the loss of three expert assistants who, one after the other, left the Bureau to accept more attractive positions elsewhere. The Bureau had not found it possible to replace them, and had no funds that could be applied to this work. The general conviction was that no satisfactory solution of this problem of making estimates is possible until there is a quinquennial census of population.

The following resolutions embody the views and conclusions of the Committee:

> WHEREAS, estimates of population are necessary for the computation of birth rates, death rates, and other rates or per capita figures; and
>
> WHEREAS, without such rates the annual compilations of data relating to births, deaths, prisoners, the insane or mentally diseased in institutions, criminal court cases, taxation, public debts, revenues, and expenditures, and other compilations which are being made by the Bureau of the Census under authorization of Congress, lose much of their value; and
>
> WHEREAS, the Bureau of the Census has always found itself unable to make fairly satisfactory estimates for more than six or seven years after the last preceding census;
>
> BE IT RESOLVED that the Committee strongly recommends a 5-year census of population; and also recommends that the Bureau of the Census seek sufficient funds to enable it to carry on research and experiments in estimating population with a view to devising methods more satisfactory than any hitherto used.

The Director of the Census outlined the plans that were being made for taking the Sixteenth Decennial Census in 1940 and submitted the tentative draft of a bill prepared within the Bureau covering that census and providing also for a quinquennial census of business and a quinquennial (or possibly biennial) census of manufactures, with annual compilations of data bridging the intervals between censuses. After some discussion the Committee concluded that they could not do better than to reaffirm the resolution adopted at the previous meeting of the Committee, which is as follows:

> RESOLVED that the Committee favors a quinquennial census covering population, agriculture, and such other related subjects as it may be desirable to include, scheduled for the years ending in "0" and "5"; also a quinquennial census of manufactures, mines and quarries, power units, communication, transportation agencies, trade, and services for the years ending in "2" and "7"; also the plan of making such annual compilations as will preserve the continuity of the data obtained in the quinquennial censuses and administer to the needs of other governmental and private agencies by the more frequent reporting of some of the basic data.

The Director stressed the importance of making adequate preparations for the decennial census of 1940 and of beginning the preparations without delay, stating that in the past they were not begun early enough, the result being that the Bureau found itself not fully prepared when the date of the census arrived. In that connection he asked the Committee for an expression of views regarding the project for a census of unemployment to be taken this coming year. The prevailing opinion was that such a census was not to be recommended, that it would not yield data of any practical value in relation to unemployment relief, and that owing to the difficulty and uncertainty in defining unemployment the data secured would be at variance with other measures of unemployment and would therefore result in a new source of confusion. The information really needed, it was contended, could best be secured in connection with a census of population containing detailed data regarding occupations and employment status. The Committee realizing that information of this kind was needed for relief work and in carrying out the social security legislation, believed that it should be included in the population schedule of 1940, but felt that any special census of population taken before that time would seriously interfere with or forestall the regular decennial census. The views of the Committee were summarized in the following resolution:

> WHEREAS, various undertakings by Federal, state, and local governments in the fields of unemployment relief and social security demand detailed data concerning occupations and employment status obtainable only in connection with a census of population; and
>
> WHEREAS, a census of population taken prior to 1940 would seriously interfere with, even if it did not preclude the taking of the regular decennial census of 1940; and
>
> WHEREAS, this Committee believes that a census of unemployment would not yield any data of practical use;
>
> BE IT RESOLVED that this Committee is of the opinion that additional data needed in relation to occupations and employment should be included in the decennial census of 1940; and that no census of unemployment or of population and unemployment should be undertaken prior to the regular decennial census.

The Committee was introduced to the new Chief Statistician for Financial Statistics of Cities, C. E. Rightor, who outlined briefly the situation in that branch of the Bureau's work. There was not time for anything like adequate consideration of this subject, but the Committee without hesitation adopted a resolution recommending that the collection of financial statistics for cities be extended to cover, as it did formerly, all cities of over 30,000; and that the collection of financial statistics of states, discontinued in 1933, be resumed.

ROBERT E. CHADDOCK,
Temporary Chairman
PAUL T. CHERINGTON
WILLFORD I. KING
} Representing the American Statistical Association

GEORGE E. BARNETT
LEO WOLMAN
} Representing the American Economic Association

REPORT OF THE COMMITTEE ON AN ANNUAL REVIEW OF PROGRESS IN MATHEMATICAL STATISTICS

The chairman of the committee was in London during the year 1935–1936 and was authorized to confer with Dr. J. O. Irwin who edits the annual survey of "Recent Advances in Mathematical Statistics" for the Royal Statistical Society, and to endeavor to arrange for cooperation between that Society and the American Statistical Association in the preparation of a joint review. For a time it seemed that such a review would be favored by the Royal Statistical Society, but the final decision was against it, at least for the present.

The Royal Statistical Society however would apparently be willing to consider a joint scheme for preparing short abstracts of papers, contributed as far as possible by authors themselves, subject to editorial supervision.

The committee is considering further what is best to be done under the circumstances, and can report progress.

PAUL R. RIDER, *Chairman*

REPORT OF THE COMMITTEE TO APPRAISE THE STATISTICAL EVIDENCE OF THE CAUSES OF THE 1929–1932 BUSINESS COLLAPSE

On May 16, 1936, the Board of Directors of the American Statistical Association authorized the formation of a Committee to Appraise the Statistical Evidence of the Causes of the 1929–1932 Business Collapse. This Committee was constituted because of the feeling on the part of some members of the Board that, at the present time, a considerable number of statistical facts relating to the causes of depression have been so thoroughly established that they are accepted by a large majority of leading members of the statistical fraternity. It was felt that, if this condition should prove to be true, a public service might be rendered by ascertaining just what statistical evidence is so accepted. With this end in view, a committee consisting of the following members was appointed:

WILLFORD I. KING, *Chairman*
SEYMOUR L. ANDREW
LEONARD P. AYRES
WILLIAM A. BERRIDGE
ROBERT W. BURGESS
PAUL T. CHERINGTON
JOHN H. COVER
GARFIELD V. COX
CARROLL W. DOTEN
GEORGE J. EBERLE
J. F. EBERSOLE
RALPH C. EPSTEIN
ALFRED T. FALK
IRVING FISHER
F. LESLIE HAYFORD
STANLEY B. HUNT
HARRY JEROME
EDWIN W. KEMMERER
WESLEY C. MITCHELL
OTTO NATHAN
FRANK A. PEARSON
HORATIO M. POLLOCK
JOHN R. RIGGLEMAN
GEORGE B. ROBERTS
NORMAN J. SILBERLING
LAURENCE H. SLOAN
BRADFORD B. SMITH
CARL SNYDER
RALPH J. WATKINS
RAY B. WESTERFIELD
EDWIN B. WILSON
LEO WOLMAN

The present speaker was designated as Chairman of the Committee. The Committee was purposely made large in order to make it as representative as feasible of the statistical opinion of those members of the Association especially interested in questions relating to the business cycle.

Because of the size of the Committee, it did not seem feasible to make progress at a meeting unless steps could first be taken to clear the ground and determine what points of agreement existed and what differences were in need of discussion. As a preliminary measure, therefore, the Chairman sent out to the members of the Committee 18 specific propositions. Each one of these propositions was accompanied by charts, tables, or both, believed to assist materially in establishing the validity of the proposition. It was, of course, assumed that the members of the Committee would view the statistical evidence presented in the light of their knowledge of other statistical evidence and other events in general.

Each member of the Committee was requested to vote in one of three ways:

1. That the statistical evidence is adequate to establish the validity of the proposition.
2. That the validity of the proposition would be established, provided the proposition were amended in a way specified by the voter.
3. That the statistical evidence is not sufficient to establish the validity of the proposition. Each voter was asked to state his reasons for believing the evidence was insufficient.

As might be expected, considerable delay was experienced in securing returns from the members of the Committee. Up to the present time, 20 members have sent in their votes. On a few of the propositions, only 19 voted.

The propositions and the votes, as recorded by those voting up to the present time, were presented at a joint meeting of the American Economic Association, in the Ballroom of the Hotel Stevens, Chicago, on December 28th.

At a later date, it is expected that a complete report may be made to the Directors of the American Statistical Association.

WILLFORD I. KING, *Chairman*

REPORT OF THE COMMITTEE ON CENSUS ENUMERATION AREAS

The Committee on Census Enumeration Areas has been able to interest people in almost all the cities of a quarter of a million or more inhabitants in census tracts to the extent of preparing the necessary census tract maps for the approval of the Bureau of the Census. Practically all of these cities either have obtained official approval for their census tracts or are in the process of revising their maps so that approval may be gained.

The manual prepared by the Chairman of the Committee and Doctor

Leon E. Truesdell, committee member has aided people in various cities in preparing census tract maps and street indexes. The edition is entirely exhausted and the manual is in process of being rewritten for publication.

The Committee held a luncheon meeting Monday, December 28, 1936, to which were invited representatives of census tract cities all over the United States. Forty-two people were present. Representatives came from as far north as Duluth and as far south as New Orleans, and from San Francisco and New Haven.

The problems with which the Committee is still faced were discussed. These problems may be summarized as:

1. Creation of a broader use of census tract data within each census tract city: use by more organizations and in more different ways
    - (a) By making census tract maps
    - (b) By preparing and publishing a useable street index by which social and business data may be readily allocated to census tracts
    - (c) By demonstrating a variety of possible local uses
2. Make definite recommendations relative to those table forms used in 1930 which have been found to be most useful, and those least useful from the standpoint of local community interests with a view to designing such forms for 1940 which will be most useable.

These problems are not yet solved but progress is being made towards their solutions.

It is believed valuable to continue the activities of this Committee for the promotion of the census tract idea both in new census tract cities and in those that have census tracts but have not taken full advantage of this "statistical tool"

HOWARD WHIPPLE GREEN, *Chairman*
C. E. BATSCHELET
ROBERT E. CHADDOCK
NEVA R. DEARDORFF
CALVERT L. DEDRICK
R. D. MCKENZIE
LEON E. TRUESDELL

REPORT OF JOINT COMMITTEE ON INCOME TAX STATISTICS

The Committee comprised Professors Ebersole, Epstein and Haig for the American Economic Association and Crum, Friday and Kuznets for the American Statistical Association. After some exchange of ideas by correspondence in the early part of the year 1936, the committee came together for a general meeting at Columbia University on March 10. All members were present except Professor Ebersole and there were in addition Mr. Stephan, Secretary of the American Statistical Association and Dr. Director representing the Treasury Department. The Committee elected Crum chairman and undertook to discuss the various points, chiefly with reference to proposed changes in personal and corporation income tax forms, which had been under consideration by correspondence. As a result of the deliberations, a memorandum of recommendations was agreed upon by the Committee and was submitted to Treasury officials. It is my belief that the changes recommended have largely been adopted by the Treasury.

No other meeting has been held since that of March 10, but that meeting authorized a sub-committee to give attention to the question of defining net income. This sub-committee, as a result of correspondence running through April and May, arrived at a recommendation as to such definition. Individual members of the Committee have at times consulted with Treasury officials on other matters relating to the interests of the Committee, but no further committee action was taken during the year.

I recommend that the Committee be continued for the coming year.

W. L. CRUM, *Chairman*

REPORT OF THE COMMITTEE ON INDUSTRIAL STATISTICS

The Committee on Industrial Statistics held its first meeting on November 11, 1936. The Committee feels that the immediate emergency has passed, so far as further serious curtailment of industrial statistics is concerned. However, it believes that the American Statistical Association should be vitally concerned with the improvement of the quality and quantity of industrial statistics. The Committee is therefore developing a long-run program to this end.

WILLARD L. THORP, *Chairman*

REPORT OF THE COMMITTEE ON RELIEF STATISTICS

The committee appointed by the Directors of the Association at the beginning of this year to exert such influence as it might toward improvement of relief statistics found in the Committee on Records and Statistics of the American Public Welfare Association another committee primarily interested in the problems of adequate statistical record of governmental relief operations. For several months the two committees worked in close cooperation. Later, with the consent of the two Associations, these committees decided to act as one on all matters within the scope of the assignment to this Association's committee, and adopted the designation, Joint Committee on Relief Statistics of the American Public Welfare Association and the American Statistical Association. This report is therefore submitted for and signed by the members of the joint committee.

The committee has met frequently during the year for general discussion and for planning specific activities. At the request of the Executive Director of the Social Security Board, it has acted as an official advisory committee to the Division of Public Assistance Statistics of the Board's Bureau of Research and Statistics. In this capacity it has advised on the general program of this Division and on the plans for monthly and annual statistics which it is collecting from state departments administering relief to the aged, the blind, and dependent children, under the public assistance provision of the

Social Security Act. At the request of the Division of Social Research of the Works Progress Administration, a sub-committee, consisting of Messrs. Webbink, Stephan, and Dr. Jeter, has been designated to advise that office concerning its new sample series of current relief statistics for rural and town areas. The committee is also represented by three members, Messrs. Hurlin, Webbink, and Stephan, on an Advisory Committee appointed jointly by the Works Progress Administration and the Social Security Board to supervise the collection from states of statistics of general relief administered through public offices.

The committee finds serious lack of integration in the statistical plans of numerous agencies of the federal government which are now responsible for the preparation of relief statistics and believes that steps should be taken to correlate the statistics which are being produced and to extend the reporting of statistics at several points at which there is now a dearth of information.

With the recent growth of relief operations, the number of persons engaged primarily in the compilation and analysis of relief statistics in federal, state, and city relief administrations has greatly increased. The committee has felt that an important service might be performed by providing means of exchange of information among these persons and others particularly concerned with the preparation and use of relief statistics. To this end two conferences for discussion of the problems of relief statistics were held during the year under the direction of the committee, one at Atlantic City in June in connection with the annual meeting of the National Conference of Social Work, the other in Washington, D. C., on December 12 in connection with meetings of the American Public Welfare Association. Both meetings were largely attended. A third such conference is to be held as part of the current annual meeting of this Association. Another activity of the committee has been the publication of an informal occasional bulletin, entitled "Bulletin of Information for Relief Statisticians." Prepared with the assistance of the Department of Statistics of the Russell Sage Foundation, four numbers of this bulletin were issued during the latter half of the year to a mailing list now including about 350 names and consisting primarily of persons working in the field of relief statistics or administrators of relief agencies.

The committee sees opportunity for further useful work along these lines and recommends that it be continued as a joint committee of the two Associations.

RALPH G. HURLIN, *Chairman*
PAUL WEBBINK, *Secretary*
NEVA R. DEARDORFF
EMIL FRANKEL
HARRY GREENSTEIN
HELEN R. JETER
HOWARD B. MYERS
FREDERICK F. STEPHAN

REPORT OF THE COMMITTEE ON STATISTICS OF DELINQUENTS AND CRIMINALS

The plan drafted last year for the development of a manual of uniform record-keeping and reporting of statistical data by judicial and penal agencies can progress no further until financial aid is available. A bibliography of the American literature on the theories, organization and function of criminal statistics is being prepared and an experiment is being made on the basis of Pennsylvania sources in developing an analytical index of the content of the tabulations in official series of state judicial and penal statistics. If this experiment proves successful, the report may serve as a model for similar indexes to the statistics of other states.

THORSTEN SELLIN, *Chairman*

REPORT OF THE COMMITTEE ON STATISTICS OF INSTITUTIONS FOR PHYSICAL AND MENTAL DISORDERS

During the past year your Committee has devoted its effort chiefly to cooperation with the American Hospital Association in the development of uniform statistics of general hospitals and out-patient services. Through conferences of representatives of several national organizations, including members of your Committee, the present status of the field has been surveyed and a beginning has been made in planning for such statistics. It is expected that in the coming year uniform definitions and statistical schedules will be devised which will meet the requirements of all agencies concerned. It is the opinion of your Committee that such statistical schedules should be adapted primarily for use by the U. S. Bureau of the Census, and the Committee will therefore work toward that end.

Your Committee has further considered the manual on hospital statistics adopted last year by the New York State Department of Social Welfare. The experience gained in the use of this manual will be of great service in the development of nationwide statistics of these institutions.

Through the effort of Frederick W. Brown, a member of your Committee who serves as a consultant to the Census Bureau, several noteworthy improvements have been made in the collection and compilation of statistics of institutions for mental defectives and epileptics. In general these improvements provide for the inclusion of more detailed data and for the separation of statistics of mental defectives from those of epileptics, both in the schedules as sent to institutions and the published reports. These changes have been approved by the Bureau of the Census and will be incorporated in the 1937 schedules.

Miss Mary Augusta Clark, a member of your Committee, submitted to the December meeting of the Committee a special report on clinic and dispensary statistics. This report makes a substantial contribution to the uniform system for which your Committee is working.

The Committee wishes to call the attention of the Association to the importance of encouraging the national Social Security Board to utilize its broad powers, to promote the establishment in each state and in the appropriate state department, of a statistical bureau which may gather and collate the great body of statistical information which will be developed out of the administration and operation of the Social Security Act. In the Committee's view, it would be extremely unfortunate if this great opportunity to establish a satisfactory statistical base for child care, old age assistance, institutional and other relief services should be missed. The Committee is convinced that the development on a national scale of satisfactory statistics in the social welfare field demands the establishment in each state of a competently directed, properly financed statistical bureau.

Your Committee wishes to call attention to the desirability of further realignment of the committees of the Association so that their activities may parallel more closely the administrative grouping of agencies and special services as set up by the federal government.

Your Committe again wishes to express its appreciation of the cooperative spirit continuously manifested by the officers of the Federal Census Bureau, and to commend the excellent work done by such Bureau in the collection and publication of institution statistics.

GEORGE W. BAEHNE
FREDERICK W. BROWN
KATE H. CLAGHORN
MARY AUGUSTA CLARK
EMIL FRANKEL
CARL E. MCCOMBS
DAVID M. SCHNEIDER
HORATIO M. POLLOCK, *Chairman*

COMMITTEE TO STIMULATE AND COORDINATE RESEARCH

The Committee has served as a conference and clearance group for the various research committee chairmen, and has served as an advisory committee to the Board of Directors during the past year. The annual reports of the various committees are now under review and a report and recommendations concerning research committee activities and personnel will be submitted to the Board at its March meeting. The Committee has held two meetings during the year.

A composite statement of research committee functions is being prepared for the Board. The possibility of Association activity in the field of civil judicial statistics is under consideration.

MEREDITH B. GIVENS, *Chairman*

REPORT OF THE REPRESENTATIVE ON THE JOINT COMMITTEE FOR THE DEVELOPMENT OF STATISTICAL APPLICATIONS IN ENGINEERING AND MANUFACTURING

During 1936 the committee has continued to act as a clearing house for information for engineers, manufacturers, and industrialists, on the one hand, and for those statisticians who wish to keep in touch with industrial problems on the other. Such service has been rendered not only to engineers and scientists in this country but also to committees and representatives of societies in other countries, particularly in the field of national and international standardization.

Eight types of problems have predominated this year. Six of these were the same as those listed in last year's report. The two new ones are: (a) fixing the meaning of, and methods for specifying, the accuracy and precision of methods of measurement, and (b) interpreting tests for significant differences.

Representatives of the committee, through the cooperation of the secretary of the American Statistical Association, have secured reports of work in similar fields in Russia, Poland, and England which have since appeared in the journal of the Association. When called upon, representatives of the committee have taken part in the discussion of applications of statistics at the meetings of certain engineering and management societies and at the meeting of the World Power Conference held in Washington this year.

Because of the rapidly developing appreciation of the usefulness of statistical methods in industry and manufacturing and the accompanying increase in requests for the services of the committee, it has been recommended to the sponsor bodies that certain other societies be invited to appoint representatives on this committee so as to cover in a more representative way the whole field described in the title of the committee.

W. A. SHEWHART

REPORT OF THE REPRESENTATIVE ON THE BOARD OF DIRECTORS OF THE NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

During 1936, the National Bureau of Economic Research published the following works:

Volumes

30 ***Ebb and Flow in Trade Unionism***, by Leo Wolman
31 ***Prices in Recession and Recovery***, by Frederick C. Mills

Bulletins

59 **Income Originating in Nine Basic Industries, 1919–1934, by Simon Kuznets**
60 **Measures of Capital Consumption, 1919–1933, by Solomon Fabricant**
61 **Production During the American Business Cycle of 1927–1933, by Wesley C. Mitchell and A. F. Burns**
62 **Revaluations of Fixed Assets, 1925–1934, by Solomon Fabricant**
63 **The Recovery in Wages and Employment, by Leo Wolman**

In addition, the Bureau has sought to develop the programs of cooperative research inaugurated last year. Six programs are now under way as follows:

1. *National Income.* The papers on various aspects of the measurement of national income presented at these meetings were prepared at the request of the Conference on National Income and National Wealth of which Simon Kuznets is Chairman.
2 *Prices.* The Conference on Prices, of which Frederick C Mills is Chairman, has been active in forming committees in the textile, oil, steel, coal, and automobile industries.
3 *Real Estate Financing.* The project on Real Estate Financing under David Wickens has made great progress.
4. *Reemployment.* A WPA investigation of reemployment opportunities and recent changes in industrial technique is being carried forward with the cooperation of the National Bureau under the leadership of Harry Jerome.
5. *Financial Research.* At the request of the Committee on Nationwide Research of the Reserve City Bankers Association, the National Bureau has appointed an Exploratory Committee on Financial Research with Winfield Riefler and Ralph Young as Chairman and Secretary respectively. This Committee has prepared an inventory of financial research now under way and a report recommending a five-year program of cooperative research in this field.
6. *Agriculture.* An agreement has been made with the U. S. Bureau of Agricultural Economics for a cooperative study of changes in the balance between agriculture and industry.

The National Bureau has acquired Hillside, an eight-acre property at Riverdale-on-the-Hudson. As soon as funds are raised to furnish and equip this property, it will be used as a center for the further development of the cooperative program.

Publications of the National Bureau may now be obtained through a new form of subscription. One payment of $5.00 per year entitles the subscriber to all bulletins published by the Bureau and to a discount of 33⅓ per cent on all National Bureau books.

WINFIELD W. RIEFLER

REPORT OF THE REPRESENTATIVE ON THE NATIONAL CONFERENCE ON NOMENCLATURE OF DISEASE

Distribution of the *Nomenclature* increased more rapidly during the year 1936 than in any previous year. There are now 270 hospitals known to be using it—an increase of 100 during the year. There is still an unknown number of others more or less acquainted with the *Nomenclature*, or actually using it without our knowledge. The bed capacity of the known users is now well over 170,000. The *Nomenclature* a year ago was being used in all the mental hospitals in Massachusetts; this year the same thing has happened in New York State.

The increasing amount of consultation with hospitals and physicians regarding the use of the *Nomenclature*, and the addition of new terms, or changes in old ones reflects an increasing interest in the *Nomenclature* and its increasing influence upon medical thought in the practical every day questions of diagnosing diseases. The experience of the National Conference has shown how necessary such an educational campaign has been. On the average, about 50 per cent of the diseases which cause death have been incorrectly named, even when the diagnosis was, or might have been, perfectly clear in the doctor's mind. Such confusion is caused by the use of ambiguous and obscure terms, so that medical statistics on some of the most important diseases are almost valueless to the physician. As a result of the work of the National Conference, this confusion is being gradually replaced by accuracy and clarity.

The work of the National Conference during the past year was supported financially by the Commonwealth Fund, the Carnegie Corporation, and the Metropolitan Life Insurance Company. About fifty hospitals became members of the National Conference and contributed in fees from $10.00 to $50.00 each.

I recommend that the American Statistical Association continue to have a representative on the National Conference.

GEORGE H. VAN BUREN

REPORT OF REPRESENTATIVES ON THE SOCIAL SCIENCE RESEARCH COUNCIL

The Council has pursued during the past year two broadly distinguishable lines of activity. The one involves financing by the Council. It places entirely in the hands of the Council the means of securing results, but is necessarily limited in scope and character to the Council's ability to raise funds. The other involves no financing by the Council. It gives freer rein to Council planning and initiative, but depends for results on voluntary cooperation of other agencies and individuals.

Activities financed by the Council during 1935–36:

in the development of research personnel—

1) eight predoctoral fellowships, open to candidates entering on graduate study, in the amount of $12,200; seven renewals and eight new appointments for 1936–37; and continuation of awards for 1937–38.
2) twenty-four predoctoral field fellowships, open to candidates having completed all requirements for the doctor's degree except the dissertation, in the amount of $39,700; ten appointments for 1936–37; and continuation of awards for 1937–38.
3) thirteen postdoctoral fellowships in the amount of $40,500; one renewal and eleven new appointments for 1936–37; and continuation of awards for 1937–38.
4) special graduate training courses in agricultural economics and rural sociology (Washington, D. C.) with course enrollments numbering ninety-one; and continuation during 1936–1937.

in improvement and dissemination of research materials—

5) preparation of a *Manual on Methods of Reproducing Research Materials* (in press).

in promotion of research projects—

6) completion of a study of population redistribution in the United States, published in one volume and four monographs.

7) final revision of a study of the measurement and growth of capital in the post-war period, and prosecution of a study of real estate financing—sections of a broad study of banking and credit in relation to economic stability.
8) initiation of studies related to social security legislation—
    a) agencies and personnel in the field
    b) Federal relief experience during the depression: description of development of policies and analysis of effects
    c) unemployment relief practices and policies in the State of New Jersey
    d) veteran's pensions in relation to old age security programs
    e) financial experience of governmental old age pension systems in other countries
    f) coordination of administration of the social insurances in other countries
    g) composition of the labor market; supply, character, distribution, recent changes, and seasonal and cyclical fluctuations.
    h) regional labor markets
    i) recording and analysis of administrative policies and practices of the Federal Social Security Board
    j) administration of public employment offices
    k) administration of unemployment insurance
    l) administration of old age assistance
    m) Federal-State administrative relations
    n) administration of grants-in-aid to local authorities in England
9) continuation of study of the Works Progress Administration and related programs
10) completion of study of the "label" codes under the National Recovery Act
11) forty-eight grants-in-aid to scholars of proved competence to assist in the completion of research of special significance, in the amount of $22,100; and forty new grants to be available in 1937–38

Activities during 1935–36 not financed by the Council beyond expenditures for planning, advice and promotion:

in relation to research organizations—

1) promotion of conference and cooperation among university social science research organizations and among students of different sciences in geographical areas or in particular fields of inquiry
2) advice to various agencies on organization, procedure, personnel and research programs
3) participation with the National Research Council and the American Council on Education in (a) a technical advisory committee on research to the National Resources Committee, and (b) in a committee of review of the Laboratory of Anthropology at Santa Fe, New Mexico

in relation to personnel—

4) study of qualifications of a selected group of applicants for entrance to graduate schools

in relation to research materials—

5) planning of nation-wide inventory of archives, manuscripts and general historical materials, and for reproduction, indexing and digesting of materials. (Taken over by Works Progress Administration.)

in relation to research projects—

6) planning of studies in the field of social security (of which a number have been noted among activities financed by the Council), with incidental service to government
7) planning of studies in the field of public administration (of which a number, particularly in relation to the administration of social security, have been noted among activities financed by the Council), with incidental service to government

8) planning by committees of continuous development of existing nuclei of knowledge around selected points
9) planning of studies of the social effects of economic depression
10) survey of research in the field of forest economics

in relation to the social utility of the social sciences—

11) planning of studies on the role of freedom of inquiry and utterance in society

The Council met four days during the year in September and April.

During the past year there has been a continuation of the generous support of the operations of the Council by the Carnegie Corporation of New York, the General Education Board, the Rockefeller Foundation, the Julius Rosenwald Fund, and the Russell Sage Foundation. New grants made to the Council in 1935–36 totalled $319,250, of which $150,000 was for fellowships; $25,000 for national grants-in-aid; $10,000 for Southern grants-in-aid; $18,750 for general administration; $80,000 for studies of administrative aspects of social security; $20,000 for a study of administrative aspects of the Tennessee Valley Authority; and $15,500 for regional studies of the labor market.

SEYMOUR L. ANDREW
WILLIAM A. BERRIDGE
EDWIN B. WILSON

REPORT OF THE REPRESENTATIVE ON THE SECTIONAL COMMITTEE ON STANDARDS FOR GRAPHIC PRESENTATION

This committee was formed in 1926 by representatives of some 25 engineering, statistical and research organizations under the sponsorship of the American Society of Mechanical Engineers. The present chairman is Col. Willard T. Chevalier, Vice President of McGraw-Hill Publishing Co. The committee is made up of a number of subcommittees, two of which reported progress during the past year.

The Subcommittee on Engineering and Scientific Graphs, W. A. Shewhart, Chairman, has been engaged during the year in the preparation of a monograph on Engineering and Scientific Graphs for Publication, which is to be a companion report to "Engineering and Scientific Charts for Lantern Slides," prepared in 1932 and issued by the American Standards Association.

The Subcommittee on Preferred Practice in Graphic Presentation, A. H. Richardson, Chairman, has completed a monograph entitled "Code of Preferred Practice for Graphic Presentation—Time Series Charts." This pamphlet is designed to codify the principles and procedures which preferred practice has indicated can profitably be followed in the preparation of time series charts. The Code, consisting of some 68 pages of text and illustrations, was issued in April 1936 and can be secured at $1.00 a copy from the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y.

A. H. RICHARDSON

REVIEWS

Elements of Probability, by H. Levy and L. Roth. Oxford: Clarendon Press. New York: Oxford University Press. 1936. x, 200 pp. $5.00

This important work on probability is not exactly a textbook nor a comprehensive treatise but occupies a position somewhere between the two. The object of the book is an attempt at unification of the various points of view from which probability may be approached and to "provide a detailed criticism of the various self contained theories of probability that have been advanced from time to time." The plan is summed up in, "in our analysis of situations relevant to probability, we have discovered three possible fields of study, all in some way interrelated and each a partial approach to the general problem;

(1) a mathematical theory of arrangements;
(2) the frequency of actual occurrences;
(3) the psychological expectation of a participant."

The authors have taken the view that, "Probability is an essential of scientific method and that a probability estimate however it is approached has to be seen and interpreted as a guide in scientific procedure."

A short historical introduction is followed by a very interesting chapter on "The Scope of Probability" subdivided into sections on "The Meaning of Chance," "On the Definition of Probability," and "Mathematical Determinism." This chapter gives a thorough review of the many angles from which the theory of probability has been approached and the various attempts that have been made to establish a sound logical foundation.

Chapters III, IV, V are devoted mainly to considerations of mathematical probability and the connection with statistics usually found in the older books on probability. The definition of probability used is, "If there is a class of N letters containing n letters a, then the probability of a letter specified as belonging to the class N, being a letter a is n/N." This probability is designated "mathematical probability." After derivations of the addition and product formulas, Tchebychef's problem, Stirlings theorem, and Bernoulli's theorem with its extensions and its relation to the normal law are taken up. (Bernoulli's theorem in these chapters covers the connections of probability with the binomial theorem.)

A chapter is devoted to the extension to continuous distributions, and a number of classical problems such as Buffon's needle problem and the random walk problem are discussed. No specific mention is made of the paradoxes that arise in this type of problem, but suggestions of their presence are made in connection with some of the problems.

Chapter VIII on "The Empirical Theory of Distributions" takes up the crucial question of how the mathematical theorems of the earlier chapters can be logically combined with empirical data to enable predictions to be made about actual events. The chapter discusses frequency distributions, hypothetical populations, some of the so-called statistical constants, the Gaussian law, and the other most common forms of hypothetical populations. The authors make a rather unusual distinction between "mean" and "average." When some member of a class necessarily takes on the measure denoted by the arithmetic mean the word "mean" is used, but there need be no member of the class which takes on the "average" measure.

The last chapter on "The Use of Probability in Scientific Induction" gives in its fifty pages a very clear and unique presentation in broad lines of the problem of sampling. The four elements in any scientific statistical problem are the sample, the population, an hypothetical population, and a process of sampling (design of experiment). In this chapter a mathematical form is given in which these four elements are associated, and the two problems of deducing the sample from a given population and of deducing the population from a given sample are put into mathematical symbolism. Many numerical problems illustrate the process, and Bayes theorem and the method of maximum likelihood are introduced into the discussion. Two dimensional distributions are considered and lead to brief discussions of regression and correlation. The chapter ends with tests of significance in connection with small samples and other tests of significance. On the whole, this chapter gives the reader an excellent birds-eye view of the problem of sampling.

Many problems of both the drill type and the thinking type are scattered through the book. Some of them are well known classics, but many are new.

A. R. CRATHORNE

University of Illinois

Statistical Methods for Research Workers, by R. A. Fisher. Sixth Edition. Edinburgh: Oliver and Boyd. 1936. xiii, 339 pp. 15 shillings.

This valuable handbook continues to grow. The materials of previous editions, which were reviewed in this Journal for 1927 (p. 411), 1928 (p. 346), 1930 (p. 381), 1933 (p. 374), and 1935 (p. 118), are included with slight alteration and amplification in details. In addition, the present volume contains examples illustrating methods of fitting polynomial regression curves to grouped data and of applying a new test of homogeneity for data with hierarchical subdivisions. The latter, illustrated by the results of a genetic experiment with peas, is *Example* 15.1, p. 111; not Section 15.1, as stated in the preface.

The table of significant values of z in the analysis of variance has been extended by the addition of a table for the probability level .001, computed by Dr. W. E. Deming. "Such high levels of significance," writes Professor Fisher, "are especially useful when the test we make is the most favorable out of a number which *a priori* might equally well have been chosen." For this and other reasons extensions of other tables in the book to more numerous probabilities would be useful. It is not always realized how profound a modification and extension of modern statistical methods is still needed to deal adequately with this problem of seemingly significant results that have arisen as a result of a conscious or unconscious process of selection from among a larger number of variates or of tests, of which those proving to be insignificant are usually not mentioned. A case in point is the conventional textbook method of choosing the greatest among a considerable number of time series correlations with varying lags. Until the mathematics of this subject is worked out, a rough but fairly good practical expedient is to decrease the probability one is willing to call significant, as the number of coefficients from among which the maximum is to be chosen is increased. But to apply this method it is necessary to have tables with smaller probabilities than .01.

HAROLD HOTELLING

Columbia University

Sul Calcolo Della Variazioni Stagionali Dei Fenomeni Economici, by Mario de Vergottini. Trieste, Italy: R. Università di Trieste. 1935. 192 pp. L. 20.

Essai sur les Variations Périodiques et leur Mensuration, by Liebmann Hersch. Rome, Italy: "Metron" Library, Series B. 1935. 184 pp. L. 25.

Any statistician interested in indices of seasonal variations will find Mario de Vergottini's book an invaluable source of information. The general setup of this excellent monograph is similar to that of Professor Irving Fisher's well-known work on index numbers. Its central part is devoted to a compressed but concise presentation of twenty-five different methods proposed for calculation of seasonal variations—as far as I know, the most comprehensive survey of this kind yet in existence. It is preceded by a general introductory discussion and analysis of different statistical measures of "seasonal periodicity." On the basis of this theoretical discussion supplemented by examples of application of each of the twenty-five methods to three empirical time series, the author compares in the last part of the book the result obtained by different methods and analyzes the comparative advantages of different procedures. To be sure, he does not attempt to invent or even to designate an ideal formula but is rather inclined to think that the selection of an appropriate method can be made only in reference to a concrete problem at hand.

De Vergottini enumerates four conditions which according to him must be satisfied by any adequate method of statistical analysis of seasonal variations:

1. Seasonal values must represent as accurately as possible the actual seasonal variations, which in concrete cases indeed cannot be discerned with complete accuracy.
2. The sum total of separate values (of a time series) after elimination of seasonal variations must equal, for every annual interval, the corresponding sum total of the original data.
3. After elimination of seasonals, the data must reveal no significant regularities in the interrelation between different monthly values or the monthly and the mean annual values.
4. The shape of the time series after elimination of seasonals must not be

> in variance with the cyclical movement which at least for certain periods might be known on the basis of some other data.

The author is aware of the fact that only points two and three approach the definiteness of a quantitative test whereas the other two constitute rather broad requirements open to very different theoretical and empirical interpretations.

Repeatedly referring in a general way to theoretical concepts or schemes underlying any statistical procedure, de Vergottini does not discuss the comparative merits of such different types of hypotheses. This reticence, however, in no way impairs the usefulness of the volume as a technical handbook on seasonal variation analysis. The attached bibliography covers the literature of the subject in Italian, German, French and English.

Professor Hersch's book resembles de Vergottini's monograph in so far as it also deals with periodical variations from a formal point of view of statistical technique. It covers wider ground by taking into consideration not only seasonal but also cyclical variations. On the other hand, his point of view appears to be rather narrow. The entire discussion is limited to development of nine types of standard indexes which are supposed to supply a complete statistical description of all fundamental characteristics of any type of periodic movements. The problem of decomposition of time series and of statistical determination of its periodic components is entirely left out of consideration. The 10 characteristics covered by Professor Hersch's indexes are as follows: (1) arithmetic average, (2) the part of a period during which a given phenomenon moves above (and below) its average, (3) number of summits, (4) the value of the moments of the extremes (the mean maximum and minimum), (5) amplitude of variations, absolute and relative, (6) deviation from the average, absolute and relative, (7) deviation from term to term, (8) coefficients of concentration, (9) coefficients of steepness and "evenness," (10), coefficient of symmetry.

The selection of these typical characteristics as well as the particular choice of appropriate statistical measures is for obvious reasons rather arbitrary. In particular, Professor Hersch has a great liking for his index of concentration σ_d: the standard deviation divided by the average absolute deviation (from the arithmetic average). He correctly states that whenever all monthly data are equal, σ_d reaches its lower limit $+1$ and shows that the maximum concentration ($+2.45$) is attained whenever all positive deviations are concentrated in one and all the negative in another single month.

Vergottini indicates in his excellent critique of Professor Hersch's procedure that in case the sum total of negative deviations exceeds the average value of the series (which does not and cannot contain negative items), they cannot possibly be concentrated in one single point but must be spread over two, three, or more months. Accordingly the value of the upper limit of σ_d falls below $+2.45$ and becomes variable, which obviously impairs the practical usefulness of such an index.

WASSILY LEONTIEF

Harvard University

Is There Enough Gold? by Charles O. Hardy. Washington, D.C.: The Brookings Institution. 1936. x, 212 pp. $2.50.

This is an excellent handbook for those now asking themselves the question which constitutes its title.

Dr. Hardy begins by defining that question. He puts it thus: "Given a general restoration of industrial activity, would the prospective gold supply be sufficient to support the prospective volume of world trade at gold price levels as high as those of 1924–29, without drastic changes in the monetary institutions which determine the amount of gold that is needed?"

The book was published in May, four months before France devalued her gold unit, followed by the like action of Switzerland and Holland, and followed soon after by the "gentlemen's agreement" between England, France, and the United States, looking toward concerted action and, possibly, the virtual replacement of the gold standard by a managed currency throughout the world.

If that happens, as so many of us fondly hope, it might seem that Dr. Hardy's question and his answer to it will be purely academic. For, by further devaluations, the number of dollars, francs, pounds, etc. could certainly be increased at will so that there would most surely be "enough gold" if not too much. In fact the perpetuation of the present devaluations might well produce the same result. Only if France goes back to her pre-September franc and if America goes back to its pre-Roosevelt dollar and England to its pre-1931 pound—all of which seem unlikely—will the question answered by Dr. Hardy have any meaning of practical importance.

Dr. Hardy also assumes that reserve requirements and similar rules and regulations affecting credit currency are to be substantially the same as they have been. "The assumption of this study is that in any general restoration of the gold standard the relationships between gold reserves and money volume which were established by world monetary regulations and customary practices in the years just before the recent collapse of the gold standard would be re-established and continued indefinitely, except for changes which have accrued since 1929 that seem likely to be permanent, such as the withdrawal of gold coin from circulation in the United States."

Dr. Hardy studiously avoids any general discussion of whether such a return to the original status quo is desirable. His sole question is, if we do so return, will there be enough gold. To this question he gives an affirmative answer. The data and reasoning by which he arrives at this conclusion seem to me convincing.

Dr. Hardy is a severe critic of his predecessors in this field. He rejects Cassel's results and method and points out how generally, in the past, predictions of a scarcity of gold have proved false. He is somewhat less critical of Kitchin.

Dr. Hardy points out that, in past periods, silver has been almost coordinate with gold and that, therefore, the sum of gold and silver money should often have been considered in our statistics rather than gold alone.

He cites Wilcoxen who showed that "the amount of metallic money actually required in the nineteenth century to support prices was much lower than the figure generally taken on the basis of Cassel's or Kitchin's researches."

He concludes that most prior estimates, including those furnished to the Gold Delegation of the League of Nations "greatly exaggerated the prospect of an early and drastic decline of the world's gold-mining industry, and particularly of the output of the Transvaal, the leading producer."

On the other hand, he thinks that the industrial consumption has generally been underestimated and accepts Edie's method by which he (Hardy) arrives at a quarter of a billion dollars (at $20.67 an ounce) annually so consumed in the period 1913–28. But for special reasons in the next decade he finds 100 million dollars a year reasonable.

His final verdict is that the problem in the immediate future "will be one of absorbing a surplus rather than compensation for a deficiency." But he adds: "equally serious is the risk that the world will commit itself to a gold standard with reserve requirements, and consequently with growth requirements, based on the swollen holdings that the depression has given us, making certain that the shortage which the Gold Delegation imagined will become a reality" after all.

In this statement, Dr. Hardy steps out of his role of a mere calculator of the adequacy of future gold under his prescribed hypotheses to point out the dangers which may confront us under hypotheses quite different from those he originally assumed. In other words, in spite of himself, he has to point out the need of a wise monetary management even if we do return to gold. A wise monetary management is, undoubtedly, a necessity for the future. No "automatic," trust-to-luck gold standard ought again to be tolerated.

Dr. Hardy believes, contrary to many, that "inadequacy of the world gold supply was not a factor contributing to the decline of prices between 1924 and 1929, and there was no immediate prospect of a serious decline in gold production before the coming of the depression."

As to future policy, he advocates "some plan under which a large part of the existing world gold stock would be segregated in extraordinary reserves" —which is exactly what Secretary Morganthau has since started to do, in December 1936. Here again Dr. Hardy finds himself advising wise management.

The last fourth of the text consists of a reprint of Dr. Hardy's pamphlet, "The Warren-Pearson Price Theory." For some reason, Dr. Hardy displays animus in his criticism of these writers, some of which criticism could readily be answered.

The first and chief of the three Appendixes is an interesting and valuable contribution by Rufus Tucker, "The Myth of 1849" to show that the effect on the price level of the gold discoveries in California and Australia in that period has been greatly exaggerated.

IRVING FISHER

Yale University

Wholesale Prices in Philadelphia, 1784–1861, by Anne Bezanson, Robert D. Gray and Miriam Hussey. Philadelphia: University of Pennsylvania Press. Industrial Research Department, Wharton School of Finance and Commerce. Research Studies XXIX. 1936. xxiii, 443 pp. $4.00.

This volume is a continuation of *Prices in Colonial Pennsylvania*, by the same authors. Naturally, as the material is more abundant for the later period, the statistical treatment can be and is more analytical than in the preceding volume. This statistical analysis is skillfully tied to non-statistical history. The study is therefore of great value not only to economists interested in the study of prices and business cycles but also to students of American history and especially the history of Pennsylvania. It furnishes a model for similar investigations elsewhere.

The outstanding feature of the book, corresponding to the plot in a novel, is an index by months of the wholesale prices of 186 commodities from 1784 to 1861, supplemented by another based on 205 commodities from 1818 to 1861. This index is the best that has been published covering that period, as it contains more commodities and is calculated as a geometric, not an arithmetic, average. Nevertheless it differs little in general appearance from its predecessors. Compared with the Warren index it shows slightly more of a war-peak in 1814 but slightly less tendency to extreme fluctuations at other times. From 1785 to 1861 it falls about 6 per cent, whereas the Warren index falls about 3 per cent. Such a discrepancy in 75 years is hardly worth mentioning, except as an interesting illustration of compensatory errors, or perhaps it would be better to say compensatory differences of method. The Pennsylvania index gives farm products much less weight than the Warren index. This by itself would tend to make the former fall as compared with the latter, because non-farm products had much more of a down trend than farm products, but the use of a geometric average of relatives instead of an arithmetic average and the heavier weighting of wines and spirits completely offset that tendency.

On this matter of weights the Pennsylvania economists assume that their index is unweighted and argue that an unweighted index is the only practicable type, since the proper weights for an index number depend on the purpose for which it is to be used and require information concerning relative consumption or trade that is not available. These are both good points, but they overlook the stark fact that some system of weights cannot be avoided. The choice of items and the consolidation of related items constitute a choice of weights.

When the authors reduced their 205 original price series to 157 for the purpose of calculating their index, they were weighting. It seems strange that they retained only one item to represent bread (plus one for flour and one for wheat) while retaining ten items for wine, plus three for rum, two for whiskey, and one for brandy. Is there any purpose for which an index number can be used for which wine and spirits deserve such high weights, amounting to more than 10 per cent of the total index? Would it not have been better for every purpose, even if wholly accurate weights cannot be ascertained, to give cotton and wool at least as much weight as Spanish brown and white lead? Can a weight of seven for tropical spices be justified when corn and hog products have together a weight of only five?

To the present reviewer the chief value of this book is the light it sheds on the internal complexities of the price structure. The diverse movements of various groups are strikingly similar to these that have attracted attention in recent years. This diversity is shown in trend and in cyclical swings, in year to year variability, and in frequency of monthly price changes. The group indexes show that from 1784 to 1861 farm crops rose 16 per cent in price, while farm derivatives (commodities made from farm crops) fell 5 per cent and imported foods fell 29 per cent. This is what one would expect with improvements in processes of manufacturing and in navigation. But why should wines rise 112 per cent while condiments fell 65 per cent?

Although the over-all trend of domestic and imported commodities was not greatly different, imported commodities had a much higher and earlier peak during the war of 1812 and did not share the price boom of the 30's. Similarly the difference between the curve of industrial prices and that of agricultural prices was not so much in the over-all trend as in the swings. Industrial commodities, like imports, had a high prices peak in 1814 and did not share the boom of the 30's; they also rose much less than agricultural commodities in the 50's.

Industrial products formed the group that showed the most stability from year to year, especially after 1822; the least stable groups were farm crops and farm derivatives. The most stable individual commodities, considering the extent of change from year to year, were rod iron, country steel, Spanish brown, glass, linen sheeting, and Madeira wine. The least stable were corn, rye, currants, lemons, ginger, and turpentine. If stability is measured by frequency of change from month to month then the most stable were steel, hoop and sheet iron, mahogany, and tin plate in about that order; the least stable were linseed oil, plaster of Paris, pig lead, whale oil, pearl ashes, and beeswax. Commodities ready for consumption tended to have less frequent changes and industrial raw materials more frequent as time went on, mainly, the authors believe, on account of improved means of transportation and communication.

The contrasts in flexibility and sensitivity shown by these price series resemble those revealed by the components of the B.L.S. index in recent years, although it is obvious that they cannot be explained on the assumption that industry was controlled and prices "administered" by big corporations. Then, as now, commodities differed in the nature of the demand for them and in the relative proportions of capital and hired labor entering into their costs of production, and in the extent to which the supply was controlled by the producers, individually or collectively, or by natural forces.

Diversities in trends and in cyclical fluctuations thus seem to be fundamental and permanent characteristics of the price structure. If this is true it follows that a currency policy designed to keep commodity prices stable is bound to be more difficult than is anticipated by those trusting souls who believe that the purchasing power of money can easily and accurately be measured by any single index of wholesale commodity prices. (The reviewer does not accuse the authors of sharing this delusion.)

This book therefore is useful not only for what it purports to show but also as an illustration of the fact that many economic phenomena of the present not only had their origin in the past but were already fully developed long before they were discovered by statisticians.

The type, tables, index, and general arrangement are admirable. Detailed figures of prices of each commodity by months are promised in a supplementary volume.

RUFUS S. TUCKER

Westfield, New Jersey

The Behavior of Money, by James W. Angell. New York: McGraw-Hill Book Company, Inc. 1936. xiv, 207 pp. $3.00.

This volume represents a statistical investigation of a number of important aspects of the behavior of the money supply of the United States, including the relationship between the stock of currency and the volume of bank deposits, the relationship of currency and bank deposits to various measures of general economic activity, changes in the distribution of money among Federal reserve districts, the exchange or turnover velocity and the circular velocity of money and their relationship to other phases of business activity.

Among the most important conclusions reached are the following: (a) that the ratio between currency in circulation and the volume of bank deposits is not substantially constant either in short periods or long, though both are correlated loosely with the activity of business; (b) that both the quantity and the exchange velocity of circulating deposits (individual plus governmental demand deposits adjusted for duplications) move with or after—not before—the rough aggregate of general measures of production, trade, and financial transactions, but not with any one of these taken separately or with commodity prices; (c) that changes in the proportion of the national total of circulating deposits in each region are significantly related to changes in that region's share in the total volume of business; (d) that the quantity of circulating deposits and their exchange velocity are apparently influenced by financial transactions in greater degree than is usually recognized, so that efforts to control business based on the fluctuations of exchange velocity are likely to be seriously misdirected; (e) that fluctuations in the national money income in 1909–1928 were much more intimately associated with those of the stock of circulating money than with those of circular velocity. From 1929 to 1932, however, the association of national income with circular velocity was somewhat closer than its association with the money stock.

The study makes no pretense of being exhaustive, and the conclusions drawn are presented cautiously. The data which have to be used in work of this sort, especially for the earlier years, are very treacherous, and no two investigators are likely to reach the same solution of some of the problems of adjustment and interpolation. The debatable points, however, generally relate to small items and have little bearing on the soundness of the conclusions which Professor Angell reaches. Further statistical work would doubtless lead to modification of the details of the argument, but, within the limits which the author has set for himself, the analysis is clear and in most points convincing. It forms a valuable addition to our financial literature.

A conclusion drawn on page 77 seems to the reviewer inadequately supported, even for a tentative statement. This is the implied approval of "the implication either that security transactions temporarily tie up substantial quantities of deposits, or that other types of activity (presumably chiefly financial) which do involve the use of substantial quantities of deposits themselves move in a fairly intimate short-period connection with security transactions." The curves in fact show very little relationship between the New York deposit relatives and the volume of stock sales for 1919–26 (aside from the fact that both rose a little in 1924 when there was a great rise in business activity), and no resemblance in 1930–34. Even in 1927–29 the short period fluctuations show little resemblance, aside from the sharp peak at the end of 1929 which apparently reflects the taking over by New York banks of loans on account of "others." Eiteman's work has, I think, pretty well ruled out the hypothesis that the stock market itself, in periods of activity, ties up any significant volume of deposits. Indeed at a later point (p. 155), Angell concludes that the quantity of money tied up in the financial class of transactions is "comparatively small." The two passages together, however, give more support to the doctrine of the absorption of credit by the stock exchange than the data, in the reviewer's judgment, warrant.

Question may be raised as to the conclusions stated on pages 150–53 concerning an upward trend of the ratio between exchange velocity and circular velocity for 1921–32 and its significance as evidence that units of money were changing hands a larger and larger number of times on the average as they passed through the consumer-producer-consumer cycle. The author notes that "so far as financial transactions are responsible for the 1929 peak in the ratio, this peak must be viewed as essentially spurious for our present purposes." But the ratio between exchange velocity and circular velocity in fact shows no significant upward trend in 1921–26. The computed trend as measured by a straight line fitted to a 1919–32 base, seems to be almost entirely due to this 1929 peak and to the comparatively high level of the ratio in 1930–32. A trend line fitted to stock sales for the entire period would show about the same upward trend as that of the ratio, which suggests that the outburst of speculative activity and the continued maintenance of stock sales at a relatively high level in 1930–32 may account for the entire rise in the ratio of exchange velocity to circular velocity.

With reference to seasonal fluctuations in exchange velocity one comment may be offered as a supplement to Professor Angell's discussion. The intra-month cycle in debits discussed on pages 108–10 appears to reflect in a significant degree the influence of income tax payments. The index of debits for the third week of each four income tax months (March, June, September, and December) is in every case above the annual average of third-week items, whereas the third-week index for every other month, except February, is below the annual third-week average.

There is an error in the right-hand scale of the Chart on page 44. Professor Angell writes me that the scale should be read in hundreds of millions, not billions.

CHARLES O. HARDY

The Brookings Institution

Population Movements, by Robert R. Kuczynski. Oxford: Clarendon Press. 1936. 121 pp. $1.50.

The book contains a series of three public lectures given at the University of London in March, 1936, together with an appendix. The first lecture, after a brief review of the state of the available statistics on the population of the world, discusses the peopling of America (North, Central, and South America) with whites and blacks; the second summarizes the author's well-known views on mortality, fertility, and the balance of births and deaths; and the third discusses the possibilities of increasing the birth rate and the relation between population trends and public opinion. An extensive appendix of 41 pages presents tables of data and estimates of the white and black races in Africa, 1835 and 1935, and in the Americas, 1835 and 1935, together with sources and comments. The title, Population Movements, is thus a term selected as comprehensive enough to cover the subject matters discussed without being intended to promise a thorough treatment of population movements.

The material on the growth of the white and black populations in the Americas and the estimates of the numbers of each race in America and Africa represent a critical summary of existing information on the subject. In the section entitled "The Peopling of America with Blacks"—a curiously worded phrase—the author accepts an estimate of about 12,000,000 Negroes imported prior to 1826 (500,000 into the United States), with a resulting Negro population in 1826 of nearly 10,000,000; in the last 100 years an additional 2,000,000 Negroes were imported, and at the end of the period the total population had grown to nearly 40,000,000. A similar discussion of the growth of the white population contains the statement that "the total number of whites who until 1820 emigrated and did not return was at least 3,000,000"—Kuczynski believes that a thorough investigation would lead to a much higher figure. The number of whites in the Americas in 1835 is estimated at 18,600,000. Immigrants from Europe from 1820 to 1935 who did not return are estimated at some 35,000,000.

It is surprising to find the statement, p. 17, that "mortality among the whites was higher still than among negro slaves," following a sentence, 'for a very long time the peopling of America with whites encountered even greater difficulties than the peopling of America with blacks." For evidence a few cases are cited of severe losses in early settlements. But such a statement is suspect, because it is counter to all the evidence of modern times based upon adequate data and seems improbable because of the evidence previously given of heavy mortality among the Negroes and the relatively much more rapid growth of the white population.

Kuczynski believes that immigration into British North America during the period from 1700 to 1800 is underestimated "by gratifying the sentimental theory that the enormous increase of the white population in the United States from 250,000 in 1700 to 4,300,000 in 1800 was almost solely due to procreation on the part of the old sturdy stock."

In connection with the estimates of the two races attention is called to the varying definitions of white, colored, and Negro in census usage. In particular, the classification of the census of 1921 in the Union of South Africa is cited: Europeans or White Persons; Asiatics—Persons born of, or descended from, races belonging to the continent of Asia, including Parsees and Syrians; Natives; and Coloured Persons. Kuczynski continues, "the policy of the Union of South Africa is thus to segregate three groups of pureblooded persons . . . and to combine in a fourth group (Coloured Persons) all pureblooded persons who are neither Europeans nor Asiatics nor Bantus, and all persons of mixed races." I have not been able to consult the census of 1921, but the Official Year Book #6, containing figures for the period 1910–1922, published in 1924, and containing the data of the population census of 1921 states, p. 132, "it will be observed that the terms white population and coloured population used in previous issues of this book have now been changed to European and non-European population respectively. Certain elements of the non-European population cannot in all cases be described as 'coloured,' though the number of such is small." The census of 1926 of the European population included 275 Syrians, 3 Armenians, and 27 Turkish, etc., as well as 569 "Hebrews so returned" in the nationality tables; one would infer that Syrians were thus considered as of European or of white race, at least in the 1926 census. Of the Asiatics (1921) 96 per cent were Indians, of whom a small number were classed to the Parsee religion; the remaining 4 per cent would include Chinese, Japanese, Malay, etc., in all 6,392. Thus the original error of including some white groups among the "coloured," which in point of numbers was never serious, has been corrected by a change of terminology; and to take the present group of European as equivalent to white is in practice not to introduce a very large numerical error.

From the point of view of numbers involved a more serious difficulty is found in Kuczynski's acceptance of the results of the census of Puerto Rico. Many persons with mixed Negro and white blood there report themselves as white, with the result that the 1,000,000 whites enumerated in the census include a great number who would be considered as colored in the United

States. This may explain Willcox's "overlooking" the million white persons in Puerto Rico in his estimate of 300,000 whites in North and Central America outside of Mexico, Cuba, the United States, Canada and Newfoundland.

The other chapters of the book need not detain us long. The discussion in the second chapter has been presented elsewhere for the most part more adequately. The principal object of Chapter III is to suggest that there may be reasons not yet adequately examined or weighed that would lead to favoring an increased population. It seems strange in such a discussion to find no mention of the question whether an increased population would lead to a higher or to a lower standard of life. The statement that "the American farmer would be better off if there were now 145 millions within the Union instead of 128" is represented as an "incontrovertible fact." But would that not depend upon how many of the additional 17 million were on farms and expecting to make their living from farming? Would it not also depend upon how large a proportion of the 17 million were added to the 10 to 15 million unemployed? It certainly seems arguable that with the larger population the standard of living of the entire nation, including the farmers, might be lowered.

ROBERT M. WOODBURY

Geneva, Switzerland

Administration of Workmen's Compensation, by Walter F. Dodd. New York: The Commonwealth Fund. 1936. xviii, 845 pp. $4.50.

In presenting this volume Mr. Dodd and the Commonwealth Fund have rendered an important and timely social service. For a quarter century compensation of industrial accidents has been our only form of social insurance, and as the administration of old age pensions and unemployment insurance is being planned we are fortunate in the possession of this careful presentation of workmen's compensation experience and the lessons with which it is replete.

The principal structural features of industrial accident compensation, as delineated by the author, are as follows:

1. Laws in forty-six states and three territories, a Federal law for civil employees of the National Government and another for longshoremen and harbor workers.

2. Premiums are paid solely by the employer. In all but four jurisdictions employers must insure their risks or furnish proof of financial ability to meet compensation payments. Security of compensation is sought through (a) insurance in private insurance companies, (b) insurance in competitive or exclusive state funds, (c) safeguards imposed on self insurers. Seven states have exclusive state funds and self insurance is permitted in all but seven jurisdictions. The predominant method is that of underwriting by stock or mutual companies under private management.

3. An amount of compensation based in practically all states upon the average wage earned before the injury but in some states within minimum and maximum limits. Many states provide that the average weekly earnings

shall include overtime and the market value of board, lodging, fuel, and gratuities. Two states pay flat amounts of weekly benefits and all states leave large discretion to those who compute the wage, even states that provide definite rules for computation of wage. All state laws permit some degree of commutation into lump sum settlements, and some allow special or additional compensation for rehabilitation purposes.

4. Provision within limits of medical treatment for the injured employee in most states, the cost of which, with a few exceptions, is borne by the employer or insurer.

5. All but a few jurisdictions require employers to report accidents, and some states require insurance companies to report accidents in the plants of their client employers.

6. Rate making could not be handled by each state separately. The National Council on Compensation Insurance, consisting of sixty-three stock carriers, twenty mutual carriers, four reciprocal or interinsurance exchanges and five state funds, has made advances in this direction, but final rate-making power resides in many organizations.

7. Merit rating of employers by insurance carriers which seeks to distinguish between individual plants in the same industries and to vary their insurance rates in proportion to hazard is growing in importance.

8. Some laws are administered by the courts, but a majority of the laws are administered by commissions. In a few states administration is vested in a single official. There has been a growing tendency to vest the administration in the same body that administers other labor laws. The experience shows that efficient administration would cost 15 per cent or more of benefits.

9. The great majority of claims are paid by the administrative officials without contest. In contested cases the usual procedure is first a hearing and then a review after the possibility of introducing new testimony before a board or superior officer, then an appeal to the trial court or to an intermediate court of view, and finally a further judicial review by the highest state court.

The American workman has derived substantial benefits from the legislation. It was estimated in 1930 that the total amount of compensation paid to injured workers is $240,000,000 per year, not including an additional $72,000,000 paid for hospital treatment and medical aid. This constitutes a total of $312,000,000 incurred because of 2,107,000 injuries among 19,683,500 workers. There is a general tendency toward liberalization of the laws and their interpretation. The amounts of compensation payments tend to increase, the waiting periods to be reduced and provisions making compensation retroactive to the date of injury if disability lasts longer than a certain period are now more common. Provisions with regard to medical care, the coverage of occupational diseases, and the reopening of cases have been liberalized, and there has been a steady upward trend in the extent of medical benefits provided.

The following are some of the outstanding faults cited: self insurance is too easily secured in many states, and a number of self insurers fail, leaving claims unprovided for; insurance in private insurance companies is the predominant method, but a number of insurance carriers have gone out of business during the depression and were unable to meet their legal obligations to insured workmen; although state funds seem to cost employers least, one authority holds that they have a poorer record than the best private carriers in promptness of benefit payment, are generally undermanned, and in some cases their employees are not of the best; the provision in most states that insurers shall be responsible for paying medical benefits has led to exploitation of the health of the employee; appointment of commissioners in the first instance is usually political—"political influence at the time of appointment and continued political influence with the party in power at the time of reappointment are certainly as influential as efficient service in the field of compensation"; the test of the depression has not been satisfactorily met by the insurance companies or by those charged with imposition and administration of governmental restrictions; to some extent the steady increase in compensation costs has been due to defects of administration.

Those who feel that the states should be free to experiment in social insurance will be able to examine in Mr. Dodd's volume the results of state experimentation run riot. The author asserts that laws have been enacted "in too much of a hit-and-miss fashion." There is great diversity among the laws, and benefit provisions are not alike in any two states. There is variation with respect to what injuries shall be reported; the length of time allowed in which to report injuries; the line of demarcation between the administrative and quasi-judicial functions exercised by non-judicial bodies on the one hand and the functions exercised by the courts on the other; whether or not employers shall be required to insure the risk or furnish proof of financial ability to meet payments; the length of the waiting period; whether all, some, or no occupational diseases shall be covered; the organization and scope of judicial review; and with respect to the relative values placed upon disabilities concerning the same parts of the body. After a development of twenty-five years, two states are still without legislation, and only eight states, three Federal jurisdictions, and three territories allow full medical benefits for the entire duration of disability.

Some of the material has special import for the administration of unemployment insurance: in the framing of compensation laws one of the most important problems was to devise a scheme which would give protection by spreading the risk as widely as possible over the industry as a whole; it is necessary to have complete information about the injury, the nature of the employment, the wages paid, the character of the disability, and the condition of the claimant at different stages of recovery; experience in reporting accidents suggests that the shorter the time set by law for the making of reports by employers, the sooner will the majority of reports be obtained; one of the most difficult problems of noninsurance is the fly-by-night employer; the problem of computing the average wage is one of the most difficult in the administration of compensation; there seems no proper basis for treating the small employer differently from the large employer with respect to his inclusion under the law; for the supervision of administrative work a single officer has been regarded as better than a board; the great mass of small employers may, unless they are able to spread the risk, have their business wrecked by a single accident; political influences are not absent in the courts of the United States, and such influences have been ever present in the administration of workmen's compensation; there is need for a greater uniformity in the laws and for a trained and permanent personnel; it is difficult to determine the extent to which merit ratings operate to decrease accidents, for the proportionate increase or decrease in premium rate will in many cases be too small to have much effect.

The author has little to suggest for the improvement of this patchwork pattern of compensation other than closer co-operation among the states. He holds that the solution of the problem of disuniformity rests with the states but recognizes that all efforts in this direction have proved ineffective. If this is the experience in a quarter century of development, to seek closer co-operation among the states seems a counsel of despair.

BRYCE M. STEWART

Industrial Relations Counselors, Inc.
New York, N. Y.

Ebb and Flow in Trade Unionism, by Leo Wolman. New York: National Bureau of Economic Research. 1936. xiii, 251 pp. 36 tables, 5 charts. $2.50.

There are two ways of writing labor history. One may put oneself in the very position of the leaders of the movement performing the continuous experimenting with the general community and with labor itself, of which labor history is the written record. By this method of approach the reader is taken over a succession of concrete situations, resembling so many campaigns, and his attention is centered on the actual process of "trial and error," the decisions made, the obstacles encountered, the catastrophes and victories, and the institutions shaped. The generalizations which emerge deal with the characteristics of the American social habitat, the basic group psychologies on either side of the line, and the types of "industrial government." The second method of approach is that of a "historical atlas of unionism." Here the dominant interest is not the particular situation, the strategy employed, or the shape of the ultimate institutional structure, but all of these are reduced to a two-dimensional expression.

The author's method is obviously the second one. Yet as an American labor student second to none in this generation for his intimate contact with industrial labor problems, both as an adviser of leaders and as an "activist" on his own accord, Professor Wolman has made his "quantitive" treatment simultaneously a most outstanding success as labor history writing of the first-mentioned variety. It is as if in watching the expansion and contraction of the red-tinted area on the geographical globe one could be made aware at the same time of the advances and retreats of the red-coated armies of Britain.

Little needs to be said about the statistical methods employed by the author. This work is a continuation of his well-known earlier one, *The Growth of American Trade Unions, 1880–1923,* and does what can be done with the data available. The data are admittedly imperfect, as unions are not primarily statistical bureaus but organizations pursuing definite practical aims, which at times may be furthered either by concealing membership data or even by deliberate misrepresentation. The author has pursued his old objective of determining the extent in unionization for the country as a whole as well as by occupations. He gives the percentage of non-agricultural employes organized as 10.2 for 1930 comparing with 19.4 in 1920 (the high watermark of American unionism) and 9.9 in 1910. It is regrettable that data are lacking with regard to the sectional extent of union organization, as the degree of penetration by unionism into the less urban sections appears of deciding moment in its quest for recognition as a national institution.

As a discussion of the problems of unionism the chapters entitled "Centers of Unionism" and "The Next Years" are most illuminating. In the former the author presents the best explanation yet given why the mining, building, transportation, and printing unions have constituted more than 60 per cent of the total membership, in good years and bad. Noteworthy is the small proportion of the total represented by unions in manufacturing, if printing and clothing are disregarded. He also discusses in this connection the important factor of the shifts in the localization of industries which are geographically competitive, such as textiles, shoes, and clothing. In the last chapter he brings out the crucial rôle of Government since the advent of the New Deal, which produced a new orientation in unionism, and ends up by saying that "the unfolding of present policies of industrial regulation and collective bargaining may well expose unions in this country, as it has in others, to governmental regulation of their policies and acts."

In the reviewer's opinion the chapter on "Representation Elections" might have been omitted without injuring the quality of this excellent work.

S. PERLMAN

University of Wisconsin

National Income and its Elements, by Robert F. Martin. New York: National Industrial Conference Board, Inc. 1936. xiii, 134 pp. $2.50.

Computation of figures for the national income is still in an experimental stage. The various methods and estimates used must therefore be examined and the different approaches explored before any one of them can finally be accepted as the authoritative method.

The calculation worked out by the National Bureau of Economic Research in cooperation with the Department of Commerce[1] is outstanding because it is based on the widest range of material. Any new computation should therefore be compared with this one to ascertain whether and in how far it offers an improvement.

The publication of the National Industrial Conference Board differs in various ways from the work of the National Bureau of Economic Research and the Department of Commerce. It applies somewhat different concepts and uses different methods for estimating some types of incomes and for breaking down the national income totals.

The author distinguishes between two types of incomes. One of them is the "realized production income" which belongs, in his opinion beyond any doubt, in every income calculation. As to the second, "other accountable realized income," he presents this separately, so that these items may or may not be added to the "realized production income," as desired. In this way, the author does not impose his special theoretical opinion upon those making use of his figures. His relativism goes too far, however, in his answer to the question whether agricultural rental and benefit payments should be included, excluded, or even deducted in the calculation of the national income. He assumes that the answer depends on the approval or disapproval of the Agricultural Adjustment Program.

Mr. Martin includes governmental interest payments (war debts!) in "production income;" this is highly questionable.

Mr. Martin's "accountable realized income" corresponds to the "income paid out" in Kuznets' terminology. He doesn't attempt to estimate the "accrued income" or "income produced." Kuznets' "income produced" (as distinguished from "income paid out") contains two elements: undistributed current profits (or disbursements of assets) and increments or decrements in the valuation of assets. Martin's elimination of the second element is, in my opinion, an improvement, because the flow of income and changes in property valuations ought to be clearly distinguished. Martin's elemination of "undistributed profits" and the corresponding negative items is, however, no improvement at all. What he should have done was to define this concept more clearly and revise its method of calculation.

The total estimates of Martin's "accountable realized income" do not differ greatly from the Department of Commerce figures for "income paid out." The greatest difference exists in the figures for agricultural incomes. Since the method applied in the computation of these figures will not be published by the National Industrial Conference Board until later, this difference cannot be discussed at this time.

The National Industrial Conference Board presents a new calculation of the distribution of the national income by states, thereby carrying on the work of the Brookings Institution[3] and the earlier work of the National Bureau of Economic Research.

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[1] S. Kuznets, *National Income, 1929–1932*, Senate Document, 73rd Congress, 2nd Session, No. 124, 1934; U. S. Department of Commerce, *National Income in the United States, 1929–1935*, Washington, 1936.

Martin's breakdown of the figures according to the reliability of the estimates is also useful. He is quite optimistic, however, in assuming that the approximate margin of error in the estimate of salaries and wages for 1929 averages only 3.5 per cent.

GERHARD COLM

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Unemployment Relief in Periods of Depression, by Leah H. Feder. New York: The Russell Sage Foundation. 1936. 384 pp. $2.50.

At a time when thoughtful people everywhere are wondering what our approach should be toward a future, long-range policy on unemployment relief, it is particularly interesting to look back over the experience of the past eighty years. Miss Feder surveys in her book the measures adopted to meet this problem in certain American cities in the depressions of 1857–1858, 1873–1879, 1893–1897, 1907–1908, 1914–1915 and 1920–1922.

It is discouraging in considering the future to be reminded of the frequency during this period of depressions sufficiently severe to require special measures to relieve the unemployment which they caused. It is also somewhat discouraging to note how little of the experience so painfully acquired during one depression remained as the starting point for approaching the problems of the next. And yet it is clear from the evidence presented in Miss Feder's study that there has been a slow and steady accretion of experience, gradually crystallizing into policy and the historical development which we recognize as social trends.

For example, Miss Feder describes how in the course of these eighty years the unit, both for planning and operation, has gradually widened from the neighborhood, racial, or religious group to the community. A tendency toward state coordination of effort is also indicated, and one can even see in President Harding's Conference on Unemployment in 1921 the seeds of what has become in this depression a recognition of unemployment as a nationwide problem and of its relief as a Federal responsibility.

One of the most interesting aspects of this historical development is the relationship between public and private agencies in the administration of unemployment relief. The apparent insistence of the private agencies that relief administration was exclusively their field over some years deserves more attention and analysis than Miss Feder has been either willing or able to give it in the scope of this study. One infers that social workers opposed the mass relief methods of most public agencies on the grounds that they were at once demoralizing and extravagant, insisting that their developing case-work techniques be applied in an individualized approach to unemployment relief. Since, however, the results of the individualized approach are described largely in terms of their restrictive effect on the case load, one wonders if in the opinion of the author (or the social workers of the period, since it is not always clear for whom Miss Feder speaks) the best relief methods are those which succeed best in keeping the apparent and articulate need at a minimum. It is possible that the obviously undesirable soup kitchen had still the virtue of demonstrating to a too frequently complacent world that there were thousands of people who were sufficiently hungry to endure the humiliation of this form of relief in order to get something to eat. This becomes interesting when one considers that we have in a sense gone forward toward a new kind of mass relief in the form of unemployment insurance and work for the unemployed. This movement toward and again away from individualized approach to the problem of unemployment relief is to me the most provocative question raised by the material assembled in this book.

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[3] M. Leven, H. Moulton, C. Warburton: *America's Capacity to Consume* (The Brookings Institution, 1934).

AUBREY WILLIAMS

Works Progress Administration

Unemployment and Prospects for Reemployment in Massachusetts, with Particular Reference to Manufacturing Industries, by Donald H. Davenport and John J. Croston. Boston, Massachusetts: Harvard University, Bureau of Business Research. Bureau of Business Research Studies Number 15. Volume XXIII, Number 6. August, 1936. viii, 73 pp. $1.00.

Recent studies of unemployment data compiled by the Federal Census of 1930 and the state enumerations of 1934 have contributed to a much better understanding of both the magnitude and the character of the problem, although there is still a pressing need for a more adequate Federal census. The present monograph analyzes the data collected in Massachusetts. Depression changes are examined in the light of long-run trends in population and employment within the state. Special attention is given to manufacturing, separate studies of some seventeen industrial classes being included within the report.

In the opinion of the authors the crux of the unemployment problem lies in the manufacturing industries. These industries have been suffering from declining trends in employment since 1919. This secular character of unemployment makes it unlikely that these industries will be able to reabsorb their unemployed in the immediate future. The lack of new industries important enough to take up the slack in unemployment and the improbability of much further expansion in trade, transportation, and service industries without a marked recovery of manufacturing activity makes the economic outlook in Massachusetts dark in the predictable future. In these conclusions the authors stand on firm ground amply supported by the statistical material of the report.

When, however, the authors turn to the solution of the unemployment problem, their position appears less tenable. Emigration of labor is recognized as a possible solution but an unsatisfactory one. This view fails to see clearly the full implications of the problem. If unemployment is "partial," i.e., confined to certain industries or industrial centers, labor transference is the only permanent solution. If, on the other hand, unemployment is "general," i.e., if the demand for labor at the general level of wages is such that the unemployed would not be fully reabsorbed, even though an optimum redistribution of labor supply among industries and industrial areas exists, the unemployment problem is national in character and involves changes in either the incomes or the productivity of the factors of production. The slowing up of population growth, the absolute decline in manufacturing employment, and the migration of gainful workers to other industrial states suggests that a significant part of the unemployment problem in Massachusetts is "partial" in character and therefore can be solved only through a movement of surplus labor to new industries and industrial areas where employment opportunities are greater.

The apprehension of the authors over the possible adverse economic effects of migration of the surplus labor upon Massachusetts could be justified only if it is assumed that the movement became so pronounced as to reduce the potential power of the state to produce. The unfavorable competitive position of Massachusetts in respect to taxation and advanced labor legislation possibly lends support to this view. There are, however, grounds for a more hopeful outlook. Mounting taxation in other industrial states, together with increasing Federal regulation of labor, suggests new elements in the situation which are favorable to Massachusetts. The adoption of Federal legislation on the subject of maximum hours, minimum wages, and child labor would do much to improve the competitive position of the state in this respect.

JAMES W. HOWELL

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International Transactions of the United States, by Ray Ovid Hall. New York: National Industrial Conference Board, Inc. 1936. xv, 230 pp. $3.00.

In this work Dr. Hall has given us a survey of the international balance of payments of the United States from 1922 through 1935, the value of the work being enhanced by the fact that the author has been primarily responsible for the compilation of the Department of Commerce annual bulletins on the subject and may be given full credit for having raised the status of balance of payments compilations from guess work to a science.

The present work may be considered a textbook in the compilation, presentation, and interpretation of balance of payments estimates that should serve as a guide to statisticians in this and other countries. The art of accumulating and auditing the vast amount of statistical material entailed in these statements of international transactions has developed so greatly during the past 14 years, owing chiefly to the work of Dr. Hall, that no one can be considered competent to discuss the related national and international financial questions nor to pass judgment on such controversial matters as war debts, transfer problems, tariffs, exchange restrictions, etc., who has not mastered the many facts and concepts set forth in this volume and in the previous annual compilations of the author.

There are a few shortcomings in the present work, and it is to be regretted that in the final table the 1935 figures, which could have been assembled at the time of publication, were not included. Chapter XI gives signs of having been loosely edited and contradicts itself in parts. For example, although admitting that "the worst blight which the depression visited upon international trade, shipping and finance is the great body of new tariffs and exchange restrictions," Dr. Hall nevertheless comments rather disparagingly on the United States policy of reciprocal trade agreements which have been the most effective, in fact the only effective, force now operating to rid the world of these encumbrances. On the whole, however, the editing has been well handled, although bearing signs of having been cut down drastically from what must have been a considerably greater mass of original material.

There are some echoes of the once famous dispute between Dr. Hall and the Commerce Department authorities, culminating, unfortunately, in the severance of Dr. Hall's connection with the Government. A minor instance is in the omission of the term "Jones invisibles," named after Dr. Hall's former division chief, and in faint traces of spleen which the editors have not completely eradicated. For example, Dr. Hall waxes vehement in his insistence on prorating 60 per cent of all errors and omissions amongst certain conjectural items and denounces the Commerce Department for not following this practice since his departure. Much is to be said however, for refusing to force figures to balance, and the reviewer believes that users of the balance of payments items in practical financial work would be better served if balance of payments compilations contained both the adjusted and the unadjusted totals. On the whole, the reviewer is inclined to agree with Dr. Hall that errors would be minimized if apportioned in this way, but his book really brings out forcibly the impossibility of leaving these adjustments in the official figures to the judgment of a single individual.

Interestingly enough, Dr. Hall suggests, as one justification for the Commerce Department compilations, that "it was of some public service to have unbiased estimates of liquor smuggling," but actually, it was the suppression of these estimates by the Commerce Department that served as one of the reasons for Dr. Hall's quarrel with authorities.

Dr. Hall's study reveals conclusively the superficiality of the pseudoscientific reports in account form, prepared by George N. Peek, which attempted to prove that our international transactions over a period of years had resulted in a net loss to the nation and concluded therefore that foreign trade was detrimental to the national interests. Dr. Hall comments: "that our nation has lost a few billions from its private long-term lending to foreigners could have been better established directly, by studying the investments themselves, rather than resorting to a crudely compiled Balance of Payments . . . certainly it was unnecessary to compile a Balance of Payments to prove that America has lost much of the war debts."

Emphasizing that no economist can have any proper conception of the importance of any single item in the balance of payments without knowing the total turnover, debits plus credits, Dr. Hall demolishes the Brookings Institution's studies of Germany's capacity to pay and the transfer problem and their later reports on the war debts question, which, "viewed separately by persons unfamiliar with the astronomical dimensions of America's total international dealings, seemed unmanageably bulky"; actually, they were "never more than about one-eightieth of our total foreign transactions and were often less."

The reviewer, from daily experience in analyzing foreign balances of payments for the practical purpose of determining transfer problems and capacities to pay foreign obligations, can testify that net figures of tourist trade, freight charges, or any item (except balancing items) are worthless. Dr. Hall brings out the fallacies entailed in pairing off one item against another, even in pairing off the debits and credits under the same category, such as using a net import or export surplus or a net tourist or credit expenditure. In analyzing "Promotions and detractions," a study originated by Dr. Hall, the author showed that it is only exceptionally that items can be paired off one against the other; that, whereas some international transactions are largely passive, others actively promote increased or decreased expenditures in one direction or the other. Foreign purchases of American merchandise do not necessarily promote American purchases of foreign goods, and there is no necessity that the two should balance; purchases of American goods by foreigners may, on the contrary, cause Americans, enriched thereby, to spend more money as tourists abroad, or add to charitable or emigrant remittances, or any one of a score of other items.

Discussing tariffs, Dr. Hall points out that "tariff reductions would increase our imports very much less than is popularly supposed." This is true. Our dutiable imports are only about 40 per cent of our total imports and approximately 25 per cent of our aggregate trade and service (invisibles) imports. Nevertheless, in correcting a popular fallacy, Dr. Hall goes to the other extreme and thereby fails to point out, in this part of his discussion, the fact that high tariffs (and more particularly quotas, exchange restrictions, and other trade barriers) are seriously detrimental to the interests of consumers in the countries imposing these restrictions and have at the same time been a major factor in the past depression through their depressing influence on world commodity price levels and through the curtailment of the actual volume of trade.

In analyzing the question as to whether "trade follows the loan," Dr. Hall shows that this has not been true, as a matter of fact, in the United States. He fails to point out, however, that the experience of other countries has not been analogous. England has been particularly careful to see that its foreign loans and investments have been earmarked for the purchase of English goods, not merely at the time of the original investment but for decades thereafter, so that English trade with many parts of the world is largely predicated upon preferential purchases in the English market by British-owned enterprises in foreign countries.

From the viewpoint of the technical expert, the 84 pages of auditing notes contained at the end of the book should be invaluable to compilers in foreign countries; likewise, the explanation of the "complete stub policy" which precludes overlooking any important item by listing all potential transfer entries, whether or not statistics are available at the time of compilation. Dr. Hall's division of the transfer entries is convenient and intelligible, viz. (1) commodity trade; (2) miscellaneous invisibles; (3) long-term capital movement; (4) short-term capital movement, and (5) pure cash. In connection with this division, Dr. Hall emphasizes that the balancing item in the balance of international payments is not gold but the entry "Net Change in International Bank Accounts."

In sum, Dr. Hall's work may be set down as one of the most important contributions to the study of international financial transactions that has been compiled and should be compulsory reading for all economists who completed their academic education prior to 1922.

GEORGE JACKSON EDER

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A Graphical Survey of the Canadian Textile Industries, by J. A. Coote. McGill Social Research Series: No. 4. Montreal: McGill University. New York: Oxford University Press. 1936. 248 pp. $1.75.

As the title implies this study provides a graphical picture of economic conditions in the Canadian textile industries. It covers for the most part the period 1917–1933, although data are given in certain charts and tables for earlier years and for 1934. According to the author, the study is an attempt to present in chart form the statistical information available in the publications of the Canadian Government about the textile industries of Canada. It is intended to encourage the use of these statistics through presenting them in a form that enables the reader to study the more important trends and relationships without the labor of assembling the necessary data from a great number of official reports and tables.

The trends and relationships for six industries are treated in detail, namely for the cotton yarn and cloth, woollen cloth, woollen yarn, silk (including artificial silk or rayon), hosiery and knitted goods, and carpets, mats, and rug industries. Charts and tables are given for each industry showing growth in terms of such measures as capital employed, number of employees, and value of product; distribution by provinces; production and import trends; changes in equipment; price movements; and certain ratios called "economic trends" including capital per establishment, capital per employee, and value of product per employee. The graphs for each industry are introduced by brief texts in which attention is called to the more significant movements revealed by the graphs.

The last chapter of the monograph is devoted to the presentation of productivity trends in which indexes of employment, volume of production, wages, and cost of living are compared. An index of productivity is obtained by relating the index of number of wage earners to the index of volume of production. There is no indication that account was taken of any changes in volume of production which might have arisen from changes in the quality or the nature of goods being produced; moreover the employment figures used were on an annual basis and presumably represented the average employment for the year. At best indexes of productivity thus derived trace only the broad relations between output and employment. From a study of these indexes the author arrived at these conclusions:

> "In general there does not appear to have been any improvement in the productivity of the worker. Cotton shows a rising overall trend since 1925 with a decided increase in 1933, but it is impossible to say as yet whether this has been sustained. Woollen cloth production also shows this improvement in 1933 but before that time practically no improvement since 1925 is indicated. Woollen yarn productivity has been going down since 1926 with a final value of less than 90 in 1933. Hosiery and knitted goods show a falling trend for three years after 1926 with a subsequent improvement, but on the average are not yet up to the level of 1926.
>
> "There are no price index figures available for all silk taken together so that only the one index for productivity can be calculated. The situation it shows, however, is very different from the other industries studied. From 1926 there has been steady and continuous improvement, and the index of productivity stood at 143 in 1933. This is evidently the product of an expanding industry attractive to capital, which is able to take advantage of the latest and best technical methods available."

Those who have reason to be interested in the Canadian textile industries should find this work most helpful. On two counts the monograph could have been considerably improved. Its appearance would have been greatly enhanced if more attention had been given to the charts. They look to be work charts; erasures are evident on several, and the cross-section background stands out so much in certain charts that the curves are hard to follow. More attention to draftsmanship and the reproduction of the charts on a white background with a simple grid would have added much to the study with probably little additional cost. This point is emphasized only because the monograph was prepared to encourage and facilitate the use of government statistics of the textile industries, particularly by business men.

Students of industry would have found the study more useful if the data presented had been accompanied by some statement of their limitations.

For example statistics are given on capital employed in certain tables without any indication of their significance; from other tables it appears that these statistics refer to total assets. A brief discussion of the form in which these data were collected, together with consideration of possible variation in interpretation by reporting establishments, would have been welcomed by many readers. Such explanations could have been segregated from the main portion of the text wherever they seemed to prevent clear-cut, straight-forward presentation.

H. S. DAVIS

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Income in Agriculture 1929–1935, by Robert F. Martin. New York: National Industrial Conference Board, Inc. 1936. N. I. C. B. Studies Number 232. xviii, 168 pp. $2.50.

The author of this volume was formerly in charge of the Income Section of the Bureau of Foreign and Domestic Commerce, which is responsible for the current official estimates of national income. He therefore brings to the reader the results of considerable experience and thought.

The volume contains valuable figures on farm income by major geographic divisions which have not heretofore been available. But its more important contribution consists in centering attention upon the inadequacies and limitations of existing data. In fact, one of the major considerations of the report is the use to which the estimates of agricultural income have been put in connection with the administration's program of agricultural relief. In attempting to disclose the erroneous conclusions drawn by some from current estimates of agricultural income, the author himself undertakes the difficult task of comparing the income of farm operators with the income of those in other pursuits. His success is, of course, only limited.

The statistical and conceptual difficulties encountered in estimating national income in general are greatly multiplied when an attempt is made to compare the incomes of special groups within the nation. When groups are compared, the concepts of income must of necessity be shifted from the purely economic considerations of market values to considerations of well-being involving intangibles which cannot be assigned economic values.

Not the least of the problems is that of definition. Who is a farmer? The census enumerates some six million persons as farm operators. Many of these, however, are farmers in name only; some have other occupations; others are so-called subsistence farmers who live almost apart from the main current of economic life. Among the farm operators are many who are responsible for large enterprises requiring education, training, and great ability; on the other hand, many are sharecroppers with a minimum of education and training and with no special aptitude. The disproportionate geographical distribution of farmers also adds to the difficulties of comparing farmers with other groups. Mr. Martin, for instance, points out that the

South comprises about 54 per cent of the farm population and only 23 per cent of the nonfarm population. This factor alone may account for a large portion of the difference between the income averages of the agricultural and nonagricultural groups.

The estimates which Mr. Martin proposes for comparison with nonfarm incomes differ from those of the Department of Agriculture principally in two respects: he calculates the farm produce consumed on the farm at retail rather than farm prices and, in addition, makes an allowance for the income of farm operators earned in other occupations. On this basis he finds that the average occupational income of farmers on the whole compares favorably with that of entrepreneurs and employees in nonfarming pursuits. At this point it is perhaps well to ask whether it would not be better to compare farm entrepreneurs with nonfarm entrepreneurs so as to avoid at least the superficial discrepancy caused by excluding employees in one case and including them in the other. But even a more detailed analysis would, of course, be necessary to make the comparison conclusive.

The use of retail prices for the computation of the value of farm products consumed by farm families raises a question of consistency which suggests the complicated nature of the problem of measuring comparative well-being of different groups. Should not some allowance also be made for the fact that many services which city dwellers receive at comparatively low prices cost the farmer very much more? Education and certain types of amusements, for example, are on the average priced differently to farmers and others because the difference in location involves an added cost (largely transportation) to the farmers. The fact that these types of services are only minor in the farmers' budgets does not dispose of the question. If the "farm prices" of these advantages were as low as city prices, the farmer would perhaps consume more.

In a short review it is impossible to cover all the points which appear significant in connection with such an important subject as agricultural income. Some readers will undoubtedly have questions with regard to the items entering into the estimates. For instance, should not some allowance be made in the occupational income of farm operators for the rental value of the farm home? The separation of the home from the farm as a business may appear somewhat artificial, especially when an attempt is made to allow for the price differential on produce consumed on the farm. Whether defaulted taxes and interest are operating expenses is also still open for question. Such farm income as is ascribed to defaults may be merely a consumption of capital, since the equities of the farmers are affected.

Although the author has not been completely successful in solving the statistical problem of comparing the well-being of farmers with that of other classes of the population, he has advanced the thinking on the subject. The failure to reach a solution is not a reflection upon Mr. Martin but is inherent in the problem itself.

MAURICE LEVEN

The Brookings Institution

Social Work as a Profession, by Esther Lucile Brown. New York: Russell Sage Foundation. Second Edition, 1936. 120 pp. 75 cents.

This monograph, enlarged in its second edition, is one of a series by the same author concerning the status of several emerging professions. It brings again to attention the question of how social work is attaining professional status. Dr. Brown directs the major portion of her discussion to education and training for social work, the development and influence of national social work organizations and of the Association of Schools of Social Work, the number of persons engaged in social work, and a comparison of salaries of social workers, primarily social case workers, in selected cities. The anomaly between emphasis on graduate education and specialization and the low salaries paid to social workers is aptly presented.

The classification of schools of social work with respect to their graduate status and their university relationships, the size of the student body and the number of students who receive advanced degrees, the academic requirements for admission to schools of social work, and the individualistic nature of the curriculum of the various schools will probably be the most discussed sections of the monograph.

The author is more at ease and helpful in presenting statistical data and in interpreting them than in discussing the more intangible but equally important information on trends, scope, and content of social work both in theory and in practice. The monograph dismisses these aspects of professional social work with a few paragraphs of discussion and omits additional reference to important bibliography which could provide the necessary supplemental reading. Although written primarily with the view that "the information may be readily utilized by vocational counselors and those who are striving to make the professions contribute more widely to the welfare both of their members and of society," the book presents so little of the various phases of social work, particularly group work, preventive and educational work, and community organization, that it seems to miss its main objective. The newer developments in social work are omitted or quickly passed over.

This reviewer believes the author attempted to cover too much area in too few pages to present adequately the movement toward professionalism, which task requires a discussion of the present in terms of the background of the past and in relation to the prospective future. It is difficult to encompass such a discussion in a small monograph.

EDITH MILLER TUFTS

Taxation and Public Policy, A discussion of the Current Problems of American and European Public Finance. Edited by Paul Studenski, with a foreword by the editors of *The Nation*. New York: Richard R. Smith. 1936. 267 pp. $3.00.

This is a reprint, with additions, of a series of articles written for *The Nation* by various contributors during the winter of 1934–1935. As republished here, the original contributions have been revised and somewhat expanded. Certain statistical material has been added by the editor, with explanatory comments. Appendices contain an editorial from *The Nation*, the President's tax message of June 19, 1935, and extracts from R. H. Jackson's testimony on the revenue bill of 1935 before the Senate Committee on Finance. The title given to this testimony is "The Economics of the 1935 Revenue Act."

The book is less unified than the title suggests. The several articles are quite separate, each being the viewpoint of the author on a subject in which he is more or less of a specialist. A. E. Buck has written on public budgeting, Philip Cornick on local taxation, Clarence Heer on the coordination of Federal, state, and local finance, John K. Norton on educational finance, F. L. Bird on municipal credit, William Withers on Federal finance, M. S. Kendrick on state finance, Gerhard Colm on European finance, and Hugh Dalton on the incidence of war costs. The editor has provided a preliminary survey, a paper on the proper financing of the next war, and one on the tax program of the future.

Such integration as may be found is supplied by the editor. The general viewpoint expressed in his papers, which does give point to the title, is that there should be even more taxation than at present. His emphasis upon this policy as a means of promptly retiring the public debt is more fortunate than his enunciation of it as a basis for the new tax system. The state is said to be a partner in business enterprise and a claimant to a part of the revenue it helps to earn. The new tax system must rest on ability plus the new theory of state partnership (p. 19).

This is not in any sense a new theory. Economists have always recognized the productive significance of government. The thing that is not settled is just how productive much of the current extensions of state activity will turn out to be. Adolph Wagner asserted that there was virtually no limit to the state's productive contribution, and the prewar German rulers proceeded to spend enormously on armament on the theory that everything done by the state was right. It scarcely needs argument to show that, although the state may be an active, useful partner in production to a certain point, it can also be a dead weight, benumbing partner beyond that point. A theory of taxation that accepts state partnership without qualification as a justification for unlimited tax exactions is seriously deficient.

The most conspicuous lack in this volume is the absence of any consideration of the present level of public expenditures and of the ways of reducing it. No attention is given to the possible utility of the existing range of public services nor to the vested interests already created in these services, which tend to perpetuate them regardless of any question of public advantage. The impression created is that there should be more taxing and spending for services as well as for debt retirement. The main implication, namely, that this is the surest way to a more abundant life for all, remains to be established.

H. L. Lutz

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INDUSTRIAL PRODUCTIVITY AND PRICES*

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I

The influence of industrial change on production and on the well-being of different economic groups has long been a matter of concern to economists. With the development of highly integrated industrial systems, the mechanization of industry and the speeding up of technological change the problems raised by technical progress have become more acute. The economic and social consequences of industrial changes are felt on a wider front, and adaptation to them may involve much more extensive readjustments.

Contemporary thought on the nature and consequences of technical and organizational advances reflects, in some degree, views that stem from J. B. Say and James Mill, in the classical controversy on the possibility of general over-production. Yet the simple lines of the earlier theory have been blurred, and far more diverse issues have been stressed in recent discussion. A facile dismissal of the problem on the assumption that an automatic adjustment to industrial shifts is effected, with re-employment of all displaced productive factors, is no longer possible. Technical change is a many-sided process that affects economic institutions and economic activities in numerous ways. The opportunities open to entrepreneurs; the flow of savings; the kind of capital goods required; the rate of obsolescence; the soundness of existing investments and of the debt structure that rests upon them; the amount of labor needed and the kind of skills required in the working force; costs and prices and the distribution of purchasing power—all these are directly affected by changes in productive technique. Moreover, the problems raised by technical changes may be quite different at different times and under different conjunctural conditions. It is a problem that calls for realistic, first hand study, that is both intensive (in its bearing on the fortunes of single industries and industrial groups) and extensive (in its bearing on the production structure as a whole and on the working of the price and credit systems).

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II

Something has been done toward the measurement of changes in industrial productivity in aggregative terms, with reference to all manufacturing industries or great groups of industries. Setting total manufacturing output against the total number of men employed or man-hours worked at different times, certain relations bearing on productive efficiency may be determined. But here, perhaps more definitely than in most fields of economic research, a specialized attack is needed. Technical conditions differ so profoundly from industry to industry that abstract measurements based on industrial aggregates fall far short of our needs. By focussing studies on individual plants and industries and the fortunes of specific groups of producers and consumers we may hope to get accurate measurements of productivity, a true understanding of the extent and character of technological changes in productive methods and information as to the direct economic consequences of such changes. The present paper deals with specific procedures that may be employed in measuring productivity changes and, more particularly, in tracing the incidence of such changes.

The manner in which a given advance in productivity may be exploited, and resulting gains divided, is obviously dependent on the prevailing form of economic organization. In a centrally controlled economy the executive authority might utilize the energy released by the advance to expand the production of consumer goods or of capital equipment, to augment the rewards of producing groups, or to increase the leisure time available to producers. A conscious decision would determine the division of the gains of enhanced productivity. The factors are more complex in an industrial economy marked by a high degree of division of labor and operating within a price system that is partly competitive, partly subject to private and public control. The first effect of a mechanical or administrative innovation in a going economy is to alter the physical organization of a producing unit. The numerical relations of men to machines, of hours of direct effort to units of output, of machines to units of output, of skilled to unskilled men, of wage-earners to salaried workers are altered. Through the system of prices these physical alterations affect the rewards of various agents of production and the costs to consumers. The pulling and hauling of competing forces, complicated by intervening frictions of many sorts, work, through prices, to determine how the benefits potential in a given industrial improvement shall be exploited and divided.

We may approach the task of tracing the incidence of productivity advances by considering some elements of the problem in simplified form. Assume that for a given industry we have measurements of the following factors:

Q = Quantity of goods produced, in physical units.

E = Effort expended in production, in energy units.

S = Sum, in dollars, for which the total product is sold. (Assume that the goods are sold directly by producers to final consumers; this is the sum paid by consumers and received by producers.)

P_1 = Index of prices of goods and services sold by consumers of the products of the industry in question. (Through the sale of these goods and services consumers acquire the sum S, wherewith to buy the products represented by Q.)

P_2 = Index of prices of goods and services bought by the producers of the goods represented by Q.

In using these measurements to trace changes over time, two conditions are necessary to complete accuracy:

1. Changes in the character of the goods represented by Q are open to quantitative definition. Important quality changes that may not be reduced to measurable terms render the index of volume of output inaccurate.

2. Productivity changes in the output of goods and services represented in P_1 are open to measurement. It is assumed that we are able to define changes in the aggregate effort expended by consumers in producing the goods and services sold in securing the sum S.

When these conditions are met, and the five basic series of data are available, changes in productivity may be measured and division of the resulting gains traced with precision.

The use and interpretation of these measurements may be discussed with reference to a series of hypothetical figures relating to conditions at two different dates.

Over the period here considered the total volume of production increased 80 per cent; total productive effort expended increased 44 per cent (it is assumed that this includes the productive contribution of any new capital equipment employed in effecting the increase in output); the gain in productivity, that is, in output per unit of effort expended, was 25 per cent. The total amount of money paid by consumers (and received by producers) for the goods represented by Q increased 116 per cent; the per unit price went up by 20 per cent.

If we are to determine how the results of the gain in productivity were actually divided, as between producers and consumers, we must pass from the money level to the level of real costs and real rewards for these two groups. The index P_1 shows that there was an increase of 25 per cent in the prices of the goods and services produced and sold by the consumers of the products represented by Q. Accordingly, the increase from 100 to 216 in the sum expended by consumers represents an increase from 100 to 172.8 in the actual volume of goods and services which consumers give for the products, Q. We have represented this volume by S_1, which we may take to measure changes in the aggregate real costs to consumers of the goods represented by Q. Since the quantity of goods received by consumers (Q) increased by 80 per cent, while the quantity of goods and services given by them in

Series	*Time "1"*	*Time "2"*
Q	100	180
E	100	144
S	100	216
P_1	100	125
P_2	100	125
Derived Measurements		
Q/E = Physical output per unit of productive effort	100	125
E/Q = Real cost, in effort expended, per unit of goods produced	100	80
S/Q = Selling price, per unit of goods produced; money cost, to consumers, per unit of goods purchased	100	120
S/E = Returns of producers in dollars, for each unit of productive effort expended	100	150
$S/P_1 = S_1$ = Sum paid by consumers corrected for changes in the prices of goods and services sold by consumers in acquiring this sum; index of aggregate effort expended by consumers in acquiring the money spent on products Q; real cost to consumers of goods purchased for S dollars	100	172.8
$S/P_2 = S_2$ = Sum received by producers for goods sold, corrected for changes in the prices of the goods and services purchased with these receipts; index of aggregate real rewards of producers, for effort expended in producing goods Q	100	172.8
S_1/Q = Real cost to consumers per unit of goods purchased	100	96
S_2/E = Real rewards of producers for each unit of productive effort expended	100	120

exchange (S_1) increased by but 72.8 per cent, consumers have reaped some advantage from the advance in productivity. The measure of this gain, on a per unit basis, is afforded by S_1/Q, which indicates a drop of 4 per cent in real cost to consumers, per unit of goods purchased.

Under conditions of increasing productivity (barring changes due to other forces) the ratio S_1/Q may be expected to fall between the limits 1.00 and E/Q. With no change in real per unit costs to consumers the ratio would stand at unity; the change in the volume of goods received by consumers (Q) would be exactly equal to the change in the volume (S_1) of goods and services given by them in exchange for these goods. If the full benefits of enhanced productivity were passed on to consumers the ratio S_1/Q would decline to the limit E/Q; the real cost of a unit of goods to consumers would be reduced by an amount equal to the reduction in effort expended by producers, per unit of goods produced. In the present example, E/Q declined 20 per cent; S_1/Q declined 4 per cent. One-fifth of the gains due to higher productivity accrued to consumers.

Turning to producers, we have an increase from 100 to 216 in the sum received for the goods produced. But the index P_2 shows an advance of 25 per cent in the average price of the goods and services bought by the producing groups with the money received from the sale of the goods, Q. Accordingly, the increase of 116 per cent in expenditures brought an advance of 72.8 per cent in real income, income in goods and services. (This is measured by S_2, secured by deflating S by P_2.)

Against the gain of 72.8 per cent in the aggregate real rewards of producers we may set the advance of 44 per cent in the total effort expended in production (as measured by E). The ratio S_2/E defines changes in the real rewards of producers, per unit of productive effort expended. This shows a gain of 20 per cent from time "1" to time "2."

The relation of the real gains of producers to the actual gain in productivity is shown by a comparison of S_2/E with Q/E. S_2/E may be expected, under conditions of increasing productivity, to fall between unity (representing no change in the real income of producers, per unit of effort expended) and Q/E. If the full benefits of the gain in efficiency were kept by producers, S_2/E would advance to the limit Q/E. In the present example Q/E shows a gain of 25 per cent in output per unit of effort expended; the real rewards of producers increased 20 per cent, per unit of effort expended. Four-fifths of the gains due to higher productivity accrued to producers.

The figures we have used are, of course, hypothetical.[1] The example serves, however, to indicate the major relations involved in tracing the results of actual changes in productivity, and to suggest a means of making the important transition from the money level of costs and rewards to the physical level of efforts and goods. If measurements approximating those assumed above may be secured for individual industries, something of value may be learned from them.

III

From records of output, labor time expended and value of fabricational operations in meat packing industries, and from supplementary price records, the following index numbers have been constructed.[2] (At a later point I discuss various qualifications relating to the approximations here employed.)

During the six years of expansion from 1923 to 1929 the volume of

Ideal measurement	*Approximation*	1923	1929	1929	1933	1935
Q	Q (Physical output of meat packing industry)	100	102	100	96	86
E	MH (Number of man-hours worked)	100	94	100	82	76
S	VA (Value added by manufacture)	100	112	100	62	72
P_1	P_1	100	109	100	70	90
P_2	P_2	100	97	100	75	82
Q/E	Q/MH	100	109	100	118	112
E/Q	MH/Q	100	92	100	85	89
S/Q	VA/Q	100	110	100	65	84
S/E	VA/MH	100	120	100	76	94
$S/P_1=S_1$	$VA/P_1=S_1$	100	103	100	89	80
S_1/Q	S_1/Q	100	101	100	92	94
$S/P_2=S_2$	$VA/P_2=S_2$	100	116	100	83	88
S_2/E	S_2/MH	100	123	100	102	115

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[1] Indeed, there is a forced agreement between the real rewards of the consumers and producers here presented, making their respective gains of one-fifth and four-fifths total 100 per cent of the actual advance in productivity. This results from the identity of P_1 and P_2. It is assumed that the goods sold by consumers, in securing their money incomes, advanced in price by exactly the same percentage as did the goods bought by producers in converting their money incomes into real incomes. This is an identity not to be expected in fact. Unless the measurements of output and effort are all-inclusive, economic agents other than the producers and consumers in question intervene, and these may absorb part of the gain.

[2] Basic records for the meat packing industry are from the Census of Manufactures. Figures on total employment (man-hours) have been derived from Census data on number employed and from compilations of the National Industrial Conference Board and the U. S. Bureau of Labor Statistics on average hours worked per week. The index P_1 is a weighted average of prices received by farmers, wholesale prices of raw non-farm products, hourly earnings of wage workers and average salaries in manufacturing industries. The index P_2 is a weighted average of the cost of living of industrial wage-earners, the prices of processed capital equipment, at wholesale, and the prices of all commodities, at wholesale.

output in meat packing increased 2 per cent; the number of man-hours worked (an approximation to the measurement of productive energy expended in production) declined 6 per cent. Total value added by manufacture (i.e., cost of fabrication plus profits) increased 12 per cent. This we take to be the sum for which the total product is sold—the product, in this case, being the contribution of meat packers in slaughtering and in packing meat products. Over the same period, the prices of the goods and services sold by consumers of the products of this industry showed an average advance of 9 per cent. (Consumers are here assumed to be made up of wage-earners, salaried workers, farmers and other primary producers.) The average prices paid by those engaged in meat packing, in purchasing means of livelihood and in investing savings, declined 3 per cent.

From these figures we derive the required measurements of productivity changes and their incidence. From 1923 to 1929 output per man-hour advanced 9 per cent. But the cost of fabrication (plus profits), in dollars, went up 20 per cent per man-hour. Taking account of the advance in prices received by consumers for the goods and services sold by them in securing their incomes, we find an advance of 3 per cent in the total real cost to consumers of the services of those engaged in meat packing. (This is the magnitude defined by S_1.) But this is the cost of an increased quantity of meat products. Per unit of goods purchased the real cost to consumers advanced 1 per cent, in spite of a decline of 8 per cent in the effort required to produce one unit of the product. Turning to the producing side, we find an advance of 16 per cent in the physical volume of goods producers could buy with the sum received for their packing operations (this is measured by the index S_2). But since the effort expended (as approximated by the measure MH) had declined somewhat, this represents a gain of no less than 23 per cent in the real rewards of producers for each man-hour worked.

In spite of the substantial gain in productivity, the real cost, to consumers, of meat packing operations advanced somewhat. The gains of higher productivity accrued entirely to agents of fabrication. Indeed, their gains on a per unit basis greatly exceeded the gains due to higher productivity. The higher costs to consumers appear, on this side of the balance sheet, as higher rewards of producers.

Comparison of this record with that of the four years of recession throws an interesting light on the developments of the two periods.[3]

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[3] In making such a comparison we may not ignore the widely different conditions prevailing in the two periods. Many factors other than productivity changes affect the rewards of producers and costs to consumers over any period of time. Such other forces were particularly strong from 1929 to 1933.

The production of meat packers declined from 1929 to 1933, but productivity increased 18 per cent per man-hour worked. Cost of fabrication, per unit of product, declined 35 per cent in current dollars, during this period of general price decline. This decline exceeded the fall in P_1 (prices received by consumers for their productive efforts), so there was a net reduction, amounting to 8 per cent, in the real cost of meat packing processes to consumers, per unit of goods purchased. At the same time, the real rewards of producers (this includes, of course, wage-earners, salaried workers, owners, recipients of interest and others whose compensation is included in the blanket sum represented by "value added") advanced about 2 per cent per man-hour worked.[4]

From 1933 to 1935 total output declined substantially; output per man-hour was reduced; cost of fabrication per unit of product rose. Real costs to consumers advanced slightly, and the real rewards of producers increased materially. The six years of recession and recovery had brought a notable gain to producers, per unit of effort expended, a smaller reduction of real costs to consumers, per unit of goods purchased.

We should note that the approximations employed in this example fall short, in many cases, of the ideal measurements we should like to have. The records of productive effort expended are inadequate, for we have taken no account of possible changes in the contribution of capital equipment. In passing from the money level of costs and rewards to the level of "real" costs and rewards, use has been made of

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Moreover, productivity changes during years of recession may reflect the influence of special circumstances (such as the closing of less efficient plants and the discharge of less efficient help) which do not affect productivity during a period of expansion. This last point is hardly relevant to the record of the meat packing industry, since production was well maintained during the recession.

[4] It will be noted that the gains of producers (2 per cent, against an increase of 18 per cent in productivity) and of consumers (8 per cent reduction in costs, against a reduction of 15 per cent in real costs) fall short of the total gains of this period. The explanation is found in the discrepancy between P_1 (prices received by consumers for the goods and services they sell) and P_2 (prices paid by producers in converting their money income into real income). The first of these shows a drop of 30 per cent from 1929 to 1933, the second a drop of 25 per cent. Only with perfect equality of change would the total rewards of these two groups exactly equal the gains due to higher productivity.

The failure of the two price indexes to agree may be due to errors of measurement, arising from inaccuracies in the price records utilized, or to the omission of important groups of consumers. It could also arise if part or all of the gains of higher productivity accrued to economic agents other than those producing and consuming the products of the meat packing industry. We may, for the sake of simplicity, assume the existence of a single additional group, buying the services of consumers (of meat products) and selling goods and services to the producers (of meat products). This third group could, by reducing the prices paid to consumers for their services and maintaining or advancing the prices charged to producers, secure for itself all the benefits of higher productivity in meat packing. Reality in market relations is, of course, more complex than this, but in some such fashion the gains of industrial productivity may be diverted to intermediary agencies—lost in the interstices of the price system. This could occur, we should note, only when we are dealing with a portion of the total productive and consumptive activities of the economy. If we have measurements relating to all productive activities no economic group would lie without the circle of producers and consumers with whose fortunes we are dealing.

available, but incomplete, measurements bearing on changes in the money value of consumers' services and the money cost of goods purchased by producers. Moreover, we have assumed that no changes occurred in the productivity of labor in the activities from which consumers' incomes were derived. Some error may have been introduced here, but it is probably not a great one, over the short periods covered.

In this example we have treated S (that is, the sum of money measuring total "value added" in meat packing) as a single item. It is possible to distinguish certain of its more important components, among both producing and consuming groups. For wage-earners in meat packing we have the measurements set forth below:

	1923	1929	1929	1933	1935
Q (Physical production)	100	102	100	96	86
MH (Man-hours worked)	100	94	100	82	76
Q/MH (Output per man-hour)	100	109	100	118	112
W (Total wage bill)	100	99	100	68	82
P_2 (Cost of living for industrial wage-earners)	100	100	100	76	81
W/Q (Labor cost per unit of product)	100	97	100	70	96
W/MH (Wages per hour)	100	105	100	83	108
$W/P_2 = S_2$ (Aggregate real rewards of wage-earners)	100	99	100	89	102
S_2/MH (Real wages per hour)	100	105	100	109	133

Concurrently with an increase of 9 per cent in output per man-hour over the first period labor cost per unit of product declined 3 per cent, and wages per man-hour, in current dollars, advanced 5 per cent. But chief significance attaches to two figures relating to changes in the level of real rewards—that is, to the aggregate real rewards of wage-earners and to real rewards per man-hour. The first of these shows a decline of 1 per cent from 1923 to 1929, the second an advance of 5 per cent. The advance in real wages per man-hour, though substantial, fell short of the increase in man-hour output. Other economic groups shared in the gain.

The four succeeding years of recession (during which output per man-hour increased 18 per cent) brought a decline of 30 per cent in labor costs per unit of product, a fall of 17 per cent in wages per hour. Turning to the two measurements that are needed properly to appraise the circumstances attending given changes in productivity, we find that real wages per hour advanced 9 per cent, while the aggregate real rewards of labor (i.e., the total stream of goods purchasable by wage-earners in the meat packing industry) dropped 11 per cent. Per unit of effort expended labor gained substantially during the recession but aggregate returns were reduced, because of the great decline in employment.

Total output and man-hours dropped from 1933 to 1935, productivity declined and the wage bill increased. Comparing the 1935 situation with that of 1929 we find the loss in the aggregate returns of labor that the depression had brought was more than made up by 1935, and man-hour returns were substantially greater. The gain of 33 per cent in real wages per hour materially exceeded the advance of 12 per cent in man-hour output.[5]

In like manner we may trace the fortunes of different consuming groups, who were lumped together in the preceding general account.

In interpreting these measurements we must compare them with the index MH/Q that defines the change in productive effort (as measured by man-hours worked) required to fabricate one unit of meat products. This indicates a drop of 8 per cent from 1923 to 1929 in the real cost of meat packing, per unit of product. Against this we find a decline of 8 per cent in real costs to salaried workers in manufacturing, and advances ranging from 2 to 19 per cent in the real cost to wage-earners, farmers and other primary producers. In general consumers paid more for the services of meat packers, although real production costs declined.

The four years of recession brought diverse results. In spite of a decline of 15 per cent in the effort needed to produce a unit of goods, the real cost of meat packing operations, per unit of goods purchased, increased 35 per cent for farmers and 1 per cent for salaried workers in manufacturing industries. The prices received by these groups for their goods and services declined more than did the cost of fabrication in meat packing industries. Costs to wage-earners and to primary producers other than farmers dropped substantially, however. The net result, as we have seen, was a substantial gain for consumers in general. The two following years of recovery (to 1935) lowered real costs of meat packing operations to farmers, as consumers, and increased such costs to wage-earners and producers of non-agricultural raw ma-

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[5] A similar analysis of the returns of "ownership and management" in the meat packing industry is possible, using as S (the aggregate money value of their product) total value added by manufacture, less wages. (This is a mixed composite, including salaries, interest payments, rentals, depreciation charges and profits, as well as tax payments and other miscellaneous items.) It is difficult, however, to secure an acceptable approximation to E, the index of productive effort expended by this group. Available records indicate an advance of 22 per cent in the receipts of this group, between 1923 and 1929, a rise of 19 per cent in overhead costs plus profits, per unit of product. Correcting monetary receipts by an index of prices paid, we have a gain of some 28 per cent in the aggregate real rewards of ownership and management. This advance substantially exceeded the gain in productivity.

From 1929 to 1933 overhead costs plus profits declined 40 per cent; per unit of product the drop amounted to 38 per cent. Over the six years from 1929 to 1935 there was a drop of 34 per cent in aggregate overhead costs plus profits, a fall of 23 per cent in overhead plus profits per unit of product. Aggregate returns to ownership and management, corrected for price changes, dropped about 20 per cent from 1929 to 1933, showed no change from 1933 to 1935.

A. Index numbers of prices received by various consuming groups for goods and services sold (P_1):

	1923	1929	1929	1933	1935
By farmers (average price received for products sold)	100	103	100	48	74
By wage-earners (average hourly wage)	100	107	100	76	94
By salaried workers, manufacturing industries (average annual salary)	100	120	100	64	*
By primary producers, non-agricultural (average price of products at wholesale)	100	92	100	73	82

B. Index numbers of aggregate effort expended by various consuming groups in acquiring the money spent on products Q (i.e., the money represented by "value added" in meat packing) ($VA/P_1 = S_1$):

	1923	1929	1929	1933	1935
Effort expended by farmers	100	109	100	130	98
Effort expended by wage-earners, general	100	104	100	82	76
Effort expended by salaried workers, manufacturing industries	100	94	100	98	*
Effort expended by primary producers, non-agricultural	100	122	100	86	88

C. Index numbers of real cost, to consumers, of meat packing operations, per unit of meat products purchased (S_1/Q):

	1923	1929	1929	1933	1935
Real cost to farmers	100	107	100	135	114
Real cost to wage-earners, general	100	102	100	85	89
Real cost to salaried workers, manufacturing	100	92	100	101	*
Real cost to primary producers, non-agricultural	100	119	100	89	102

* Data not available.

terials. The status of wage-earners remained distinctly better than in 1929, however.

IV

In seeking to approximate the ideal measurements through which the character and incidence of changes in industrial productivity and in industrial costs may be defined, I have made use of data not gathered in the first instance with reference to the problems with which we are here concerned. These data do not meet our needs. Direct studies on the ground may be expected to yield more precise data, more suitable to the purpose in mind. It is appropriate to suggest ways in which more satisfactory measurements may be secured.

a. Strict comparability among the three major measurements (and subordinate items) is essential. These measurements are those represented by Q (physical output), E (productive energy expended) and S (the value series corresponding to Q). In compiling data relating to a given plant or industry effort should be made to ensure that the man-hours or other energy units defined in E represent all the effort (and no more) put into the production of the goods represented by Q, and that the value series represented by S relate to the exact physical units represented by Q. Full comparability is not easy to achieve, particularly when changes over time are being traced; usually we have to be content with something less than perfection. But if Q, E and S do not relate to exactly the same area of activity, there should be no important variations from time to time in their respective degrees of coverage.

b. High accuracy should be sought in the index of physical output. Changes in quality are perhaps the chief disturbing factor here. When a quality change is open to definition and reduction to quantitative terms (as when an instrument is made 40 per cent more efficient), the index of physical output may be modified to take account of it. Only when no quality changes occur, or when such changes may be reduced with some precision to quantitative terms, may changes in productivity and in costs be traced in satisfactory fashion.

c. Perhaps the greatest difficulties are faced in the exact measurement of productive energy expended. It has been customary, in default of better standards, to define productivity in terms of output per capita, this usually meaning output per wage-earner employed in direct production. If measurements of this type extend over time they are subject to three defects. Hours of labor are subject to change; the quality of labor (the degree of training and skill required in the working force) may change; the ratio of direct labor to indirect labor (embodied in capital equipment and employed in a variety of indirect productive services) may vary materially. The "per capita" standard may be improved, when information as to average hours worked per week is to be had, by measuring changes in output per man-hour worked. It is more difficult to allow for changes in the quality of the labor entering into production. If records of hourly wage rates are available the index of total man-hours worked in a given period may be a weighted aggregate, man-hours of effort at different levels being weighted by corresponding wage rates. Such weighting may not be appropriate to all purposes. Indeed measurements of productivity lose in direct physical significance when a value factor is thus introduced.

Problems of another order are faced in seeking to take account of labor indirectly entering into production. When the amounts of servicing, supervising and subsidiary labor are known, they maybe combined, properly weighted, with direct labor. The matter is more complicated for labor represented in the technical instruments of production.

When we are dealing with the output of a whole economy the quantity Q (constituting the numerator of the fraction Q/E) includes, over a stated period, the production of all goods intended for consumption, plus net additions to the capital equipment of the economy. The corresponding index, E, of productive effort expended should include all labor expended on the production of goods intended for consumption, plus labor employed in producing additions to capital equipment plus labor expended in the *maintenance* of all equipment existing at the beginning of the period. The productive contribution, over the period covered, of pre-existing equipment is measured by the labor required to maintain that equipment at the level of efficiency prevailing at the opening of the period. (The labor expended in producing that equipment will have been set off against the equipment itself in periods prior to that with which we are here concerned.)

In dealing with a single industry a somewhat different procedure is needed. Here the index Q, for any period, must include all the goods produced for sale by that industry, whether they be intended for human consumption or for capital equipment. The index E, of productive effort expended, must include the total man-hours of labor time (including the time of salaried employees), plus the man-hours of time required to maintain the equipment that was in use at the beginning of the period.[6] Accurate annual depreciation charges, duly corrected for changes in costs arising out of variations in the value of money, provide acceptable current measures of this effort. Reduced to relative numbers, and appropriately weighted, this element may be combined with the index of labor time to give a measurement of total effort expended in production.[7]

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[6] If part of the industry's productive effort is used to produce new equipment for its own use, such additions to capital equipment would be added to the index Q, and the corresponding effort added to the index E.

[7] The difficulty lies, of course, in securing accurate depreciation charges. These are seldom available, even in the detailed accounts of individual enterprises.

A rough indication of the relative importance of this factor in the meat packing industry may be secured by estimating depreciation charges for the entire industry from the published statements of three large companies. We obtain figures of 27 millions of dollars for 1929, 19 millions for 1933. (The total wage bill of the industry in 1929 was 166 million dollars.) Correcting these depreciation charges for changes in the cost of capital equipment, and combining with the index of man-hours of labor, we have an index E (effort expended in production) for 1933 (on the 1929 base) of 80, in place of the index 82, relating to man-hours alone. The corresponding index of productivity for 1933, on the 1929 base, becomes 120, as compared with the measure of 118 computed for man-hours alone. A similar calculation yields a productivity index of 114 for 1935, on the 1929 base, as against an uncorrected index of 113. The depreciation estimates are rough, but the corrected indexes are probably closer to the truth, since some account is taken of the changing contribution of capital equipment.

In many cases it is not possible to extend the index of productive effort beyond the simple record of man-hours expended by wage-earners. When the index is thus restricted we must recognize that the instruments used by wage-earners and the ratio of supervisory and ancillary labor to direct labor vary over time. The usual result of this restriction, in a period when capital equipment is being augmented, is an over-statement of actual gains in productivity; in a period of general contraction the error may lie in the other direction. Information concerning capital investment will supplement the measurements of productivity and aid in their interpretation.

d. Knowledge of the component elements of S, the total sum received by the producers of the goods represented by Q, is required in a study of the division of productivity gains. In the preceding example total fabrication costs have been broken into portions accruing to wage-earners and to "ownership and management." The last item is a heterogeneous mixture, which should be broken down further. The sums constituting overhead proper should be distinguished from profits; interest and salary payments should be distinguished from other elements of overhead; tax payments should be separately measured. This division of the total sum received for the products sold makes it possible to measure production costs (average costs)[8] and changes therein, and is essential to tracing the true incidence of changes in productivity.

e. Beyond the field of industry studies proper, but of profound importance in measuring the consequences of changes in productivity and the actual allocation of economic gains, lies the task of constructing the indexes P_1 and P_2. These are the measurements of changes in the prices of goods and services sold by consumers and of goods and services bought by producers. The task is that of constructing bridges for passage from the money level of costs and rewards to that of real costs and real rewards. The deficiencies of monetary records of wage and salary rates and of income have been made obvious by the wide price swings of recent years. Equally faulty are quoted prices as measurements of the actual costs, to consumers, of goods and services purchased. For a dollar of money income, to be expended by a consumer, may at different times represent quite different outlays of effort on the part of the income recipient. Account must be taken of variations in the prices received by consumers for their productive efforts if we are accurately to definite the results of technical progress.

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[8] Since the analysis proceeds from measurements of aggregate output and aggregate costs and value to unit costs and unit selling prices, it is limited to average costs and corresponding rewards. The refinement of analysis that would be made possible by detailed records of differential costs is not here discussed.

It is not enough to know that productive efficiency in manufacturing has increased 20 per cent. We should know what effects this may have on the real costs of manufactured products to consumers. This is true even though we are concerned only with the fortunes of a single industry. It is doubly true when we are interested in the broader effects of technical progress on standards of living, on the utilization of productive resources, and on the amount and character of employment available to industrial labor.

The deflating indexes appropriate to our needs in passing from money levels to real levels must be numerous, and adapted to specific groups of consumers and producers. The task of constructing these is not for those engaged in studying particular industries. It is a proper task for bodies with broader responsibilities, for research agencies and federal bureaus.

V

The influence of machine technology on the fortunes of economic classes and the division of economic power has been a subject of discussion in economic literature since the full force of the industrial revolution was felt in nineteenth century England. The present paper has dealt with some of the contributions that detailed field studies of American industries may make to our knowledge of technical progress and its consequences. In place of sweeping generalizations based on limited observation we need a body of knowledge derived from intensive investigations. Important contributions have already been made by Barnett in his pioneer work on the glass industry, by Elizabeth Baker on the printing trades, by the United States Bureau of Labor Statistics, by the Minnesota Employment Stabilization Research Institute, and by Jerome in his comprehensive study of mechanization. The survey of productivity and industrial techniques that is now being conducted by the Works Progress Administration and associated agencies will yield further knowledge. Such concrete studies of productive operations and of requirements will give us an appreciation of the true inwardness of the machine age.

It is clear that for an understanding of the role played by changing technology today we must go beyond the record of changing techniques in individual industries. Mechanical and managerial changes affect economic organization and the lives of the human elements of that organization through the system of prices—through their influence on returns to capital, on profits, on wages and wage rates, and on the purchasing power of individuals and groups. The incidence on prices of changes in production lies at the heart of the problem raised by industrial change.

The working of a modern economy involves contact between productive energies and purchasing power. A gain in productivity brings, on the one hand, a release of productive energies; less effort is required for the production of a given quantity of goods. On the other hand, a gain in productivity brings (almost invariably) a shift in the distribution of purchasing power, a shift from group to group or a change in the distribution within a group. The essential problem of readjustment is that of establishing a connection between the released productive energy and the purchasing power thus shifted. Under contemporary conditions this connection can be established only through the system of prices. Whether it be directly and readily established, with only temporary dislocation, or whether the process be long drawn out, with protracted unemployment of productive resources, depends in good part upon the original incidence of the change and upon the number and character of the frictions retarding a realignment of productive agencies and a readjustment of producer-consumer relations. In an economy marked by numerous frictions the pains of readjustment may be minimized, as I have suggested elsewhere, when the gains of industrial progress are widely diffused.[9] When the gains are narrowly restricted the economy may operate for an extended period at an inefficient level.

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[9] See *Prices in Recession and Recovery*, National Bureau of Economic Research, New York, 1936.

HIGHLIGHTS OF THE 1935 CENSUS OF BUSINESS*

By F. A. Gosnell
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The 1935 Census of Business is the most comprehensive business statistical undertaking that has ever been known. It is interesting to check the growth of this enterprise since its beginning in 1927. In that year a test Census of Retail and Wholesale Trade was made covering 11 cities, in which there were collected 111,000 schedules. The 1929 Census of Distribution included retail and wholesale trade, hotels, construction, and distribution of sales by manufacturers. There were 1,873,000 business units included in that census. The scope of the 1933 Census of American Business was changed so as to include service establishments and places of amusement and exclude construction and distribution of sales. During that year there was a total of 2,193,000 reporting establishments. The 1935 Census of Business includes retail and wholesale trade, service establishments, places of amusement, hotels, construction, bus and truck transportation, radio broadcasting, insurance and real estate, advertising agencies, warehousing, banking and finance, distribution of sales by manufacturers, and the operation of commercial and other non-residential buildings, for which there have been obtained approximately 3,000,000 reports.

The information for the 1929 census was obtained on 15 comprehensive schedule forms. In 1933 the information was collected on a single form which was prepared in such a way as to obtain basic facts only from all kinds of business coming within the scope of that census. In 1935 we have used 16 schedule forms which provide more or less detailed information covering various fields of business. In determining the detail in which the information should be obtained, consideration was given to the availability of statistical information from all Governmental sources so as not to duplicate the work of other agencies. It was decided, for example, that the only essential additional information that should be obtained for banks and financial institutions was employment and pay roll data by occupational classes. In contrast, the wholesale questionnaire, counting each commodity item separately, included more than 300 questions for which we attempted to obtain information.

Most of you are familiar with the type of tables that are used in presenting the results of a Business Census. I shall, therefore, not discuss these tables other than to give you a brief report on the progress that is being made in their production and publication.

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* Part of a paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association (at a joint session with the American Marketing Association), Chicago, December 28, 1936.

The first complete report of the Census of Business covered radio broadcasting. The second was the preliminary summary on Retail Trade, published on October 15, 1936. Until this report was issued, no one knew to what extent retail trade in the United States had recovered from the depths of the depression which, I believe, was pictured fairly accurately by the 1933 Census of American Business.

On October 22 there was published a preliminary report on service establishments, followed by the United States Summary for Wholesale Trade, released on November 27.

Each of these reports contains basic information on the number of business establishments, their net sales or operating receipts, employment and pay roll during 1935. In the Retail and Service reports, the data are shown for each state, each county and each city of more than 2,500 population. Data on Wholesale Trade are presented for states and for counties and for cities of more than 5,000 population.

Within a few days the Retail type volume will be issued, presenting basic facts for independents, chains and other types for states and for cities having a population of more than 500,000. As in previous censuses, the type tabulations are limited primarily to the kinds of business in which chains operate.

One of the most discussed types of business at the present time is the consumer cooperative. For the first time we have been able to obtain some information which will throw light on the extent to which this type of business has thrived. Likewise, much valuable information will be presented for voluntary chains. It is unfortunate that no facts were collected in the previous censuses by which results may be compared. Observation, however, leads us to believe that there has been a remarkable growth in these types of stores.

Following the type of operation information we shall present commodity sales data, which unfortunately were omitted from the 1933 census. We have collected sales for approximately 200 commodities from more than 100,000 establishments doing a business of $50,000 or more. The answers to the commodity inquiry are necessarily not consistent in all reports. We feel, however, that there is a sufficient number of reports giving reasonably accurate information from which we shall be able to prepare tables which will give an index of commodity sales by kinds of business by states and for principal cities. This is one of the most difficult and complex tabulations being undertaken as a part of the Census of Business, and the information will not be available until sometime in the spring.

The officials of the Bureau of the Census are aware of the fact that we still have a long way to go in developing the technique of preparing and presenting the statistics of business. The success of a business census depends, to a large extent, upon the proper enumeration of the establishments. This is the most difficult problem facing the Bureau. The scope of a Business Census is so complex that it is difficult even for the Bureau staff, which has charge of and is responsible for the job, to fully comprehend its problems. In preparing instructions for the field agents who collect the information, it seems impossible to condense them to less than approximately 100 pages of printed material. Many of the explanations are necessarily technical and difficult for the average field agent to understand. The Census of Business for 1935 being of such a comprehensive nature, the results have not been entirely satisfactory for all of its phases.

It is an easy matter for the field agents to determine in most instances whether an establishment is a retail store, garage, or hotel, but it is frequently impossible for him to determine whether a manufacturer is selling his goods at wholesale through a sales branch, or whether certain types of firms should be included in the Construction or Real Estate Census.

One of the problems which appears to be insurmountable is the contacting of a large number of business concerns which do not have definite, recognizable places of business. This is particularly true in the insurance, real estate, transportation, and construction fields. During recent years a great deal of our residential construction has been carried on by small operators who have no place of business other than their residences. This is more particularly true of subcontractors such as plumbers, electricians, carpenters, and bricklayers. In enumerating trucking for hire we have experienced no difficulty with large transportation companies which own a fleet of trucks. A great deal of the truck transportation, however, is conducted by persons who own one or two trucks and have no place of business other than their homes. These we were unable to enumerate with any degree of accuracy.

We are now convinced that it is not possible to take a complete census of every phase of American business through a single enumeration force. It is my belief that future Censuses of Business should be broken up into smaller sections, retaining in the principal division such businesses as retailers, wholesalers, service establishments, and hotels. The other phases which are included in the present Census should be specialized jobs. For instance, a much more accurate and thorough job would be accomplished on transportation if an enumerator, who was employed in the city for the purpose of collecting such information, had nothing to concern him other than making a thorough survey of that field. This likewise applies to the insurance and real estate field, construction, and professions (which were dropped from this census in its early stages) and other special types of business such as advertising agencies and the operation of commercial and other non-residential buildings.

Breaking the census into smaller sections alone, however, would not solve all our problems. There must be a more adequate central control of the canvass for every phase of American business. The temporary nature of the work makes it impossible to obtain a large number of enumerators for two consecutive censuses. Therefore, in using this method there is a lack of uniformity in the canvass. In the censuses of 1929 and 1933 an enumerator was assigned to a district which contained approximately 100 to 500 businesses coming within the scope of the census. He was furnished no lists whatever, but was instructed to call on each establishment in his district and obtain a report, or explain to his supervisor why the report was not obtained on his first call. There was some improvement in the method used in the 1935 census. Index cards were furnished the enumerators for all retail trade establishments doing a business of $20,000 and over. Owing, however, to the rush of work in connection with the editing, coding and otherwise preparing the schedules for tabulation, it has not been possible for the office to have a sufficient staff to make a thorough check of the enumerators' work by districts. It is believed, however, that this census includes more than 95 per cent of the total businesses of the country falling within its scope. Our objective is to obtain 100 per cent, and any letting down in this respect would soon result in the canvass deteriorating to such an extent that a very much larger percentage of the total business would be lost from the tabulations.

With this in mind, the Business Census Division is now preparing a complete card index of all retail and wholesale trade and service establishments for which reports were obtained in the 1935 census. A master card has been prepared on which will be entered such basic facts as sales, employment, pay rolls and expenses for each census year. We will also include on this card the classification of the establishments for the various censuses which will give us an excellent opportunity to make special studies of the reasons why trends from one kind of business to another are not uniform. This record will provide a permanent history of all business concerns.

It is the policy of the office to classify an establishment in the kind of business represented by the major portion of sales or revenue. For example, many of the principal retail hardware stores are also engaged in wholesaling. If the wholesale operations exceed the retail operations, it is our policy to include that concern in the Wholesale Census. When the next census is taken, the reverse may be true and the same establishment would be tabulated in the Retail Census, thereby showing an unwarranted decrease in wholesale hardware trade with a resultant overstatement of retail trade. This is true of many kinds of business, such as lumber yards, automobile establishments where the establishment acts in the dual capacity of distributor and dealer, and the hay, grain, and feed business.

A card record is also desirable owing to the so-called "hair-line" decisions which must be made in classifying those dual-line establishments which might take either of two kind-of-business classifications. This is particularly true of stores selling such combinations of lines as furniture and hardware, groceries and feed, clothing and general merchandise, or coal and building materials.

Heretofore, census data have been published for cities as a whole. With minor exceptions, no information has been presented for shopping or neighborhood districts within cities such as Chicago, New York, and Philadelphia. There has been, however, since the first complete Census of Distribution in 1929, considerable pressure from various sources for a more detailed breakdown of the retail trade information for areas within the principal cities. The Bureau has not had, until the present time, the facilities for making a comprehensive study of the most practical methods of presenting such data. The 1933 census was taken and completed in a very short time with inadequate funds and it was, therefore, impossible at that time to make a study of this problem. For the past several months the Business Census Division has been making such a study.

The real problem is to determine a suitable business area layout and to make sure that the business data desired for marketing purposes can be compiled and published for these areas without disclosing the operations of individual concerns. Consideration was first given to a plan for dividing the entire city into large communities by combining previously established population census tracts. This method was subject to the objection that in many instances the principal business streets serve as boundaries for the census tracts; hence, combining tracts might split the business centers. The plan would permit a study of retail trade for more or less homogeneous population areas but it would not afford an analysis of important concentrations of business. Also, community areas arrived at in this manner would include residential and other sections not devoted to or zoned for business uses. Statistics for the large area would not sufficiently localize certain kinds of business to be of maximum value for sales promotion and market analysis. For this purpose it would be necessary to show tabulations for centers or thoroughfares within the larger areas.

Attention was next given to a study of the principal thoroughfares. It is characteristic of most cities that a large portion of the retail stores are located along a few principal streets; in Philadelphia, for example, along Broad Street or Chesnut and Market Streets. Studies show, however, that although business tends to front on the principal streets, particularly at the intersection of transportation arteries, a substantial volume of business is done on cross or parallel streets. Consequently, retail tabulations for principal thoroughfares or segments thereof alone would not furnish adequate information.

Each large city possesses a more or less well defined central business district, which is avoided by through traffic, where space is at a premium, and where buildings grow skyward. This district constitutes the principal shopping center and within its confines is conducted a large portion of the retail trade of the city; hence, an analysis of this district by kind of business is highly desirable.

Within each city there are, in addition to the central business district, a number of more or less well defined outlying business centers. In these centers, as a rule, will be found a predominance of stores that specialize in shopping goods with an important addition of convenience goods business. The latter will not be found to any great extent in the central business district. Any intra-city study not providing for these outlying centers would be incomplete.

There are also special features of each city that would not be brought out by the grouping of census tracts, by studying segments of business thoroughfares or by analyzing the business centers. For instance, one of the most individual chacteristics of Philadelphia is the business done on South Street. Here for 10 or 12 blocks one finds a large number of stores, practically all of which are selling distress merchandise, rejected or discontinued styles. Therefore, statistics which would not segregate data for this market would not furnish to the manufacturer and distributor of merchandise a true picture.

Our experiments indicate that the most satisfactory method of making an intra-city study is first to tabulate the business of the large community areas comprised of census tracts. These data must be supplemented by tabulations for the central business district, for outlying business centers, and for segments of principal business thoroughfares. Special attention must also be given to any peculiar characteristics of the city. We have, following this method, made experimental tabulations of the 1935 retail trade reports for the City of Philadelphia. We are pleased with the results of this work to date but we do not consider the job finished and solicit your suggestions.

It was not until fifteen or twenty years ago that marketing research came to the fore and was recognized as essential not only in marketing but in gauging production and consumption. In the past, therefore, it was not so essential that the Census reports covering the various subjects be published with as much promptness as is demanded today. Neither was it necessary for these reports to have as widespread distribution, as they were looked upon more as a history than as furnishing valuable up-to-the-minute marketing information. The Bureau of the Census recognizes the fact that the earlier reports are published, the more valuable they are. The information for some purposes is highly perishable. With this in view, we are constantly striving to advance as much as possible, the date on which the information becomes available. Development of a better technique in the collection of the information, of which I have already spoken, must necessarily give adequate consideration to reducing materially the time required to obtain the information.

I think you will agree with me that we have made rapid strides in this direction in compiling the information for the 1935 census, when I tell you that the data contained in the two Retail Trade volumes, totalling 516 pages, that were published on December 15, were produced between the dates of October 29, when the field work was completed, and the date on which they were issued. Normally this process would require five or six months. One of the principal features in producing a report so quickly is the fact that the entire operation, including the printing, is carried on in the Philadelphia office. We do not claim all the credit for producing the report so promptly. It has been brought about partly by business concerns, particularly research agencies, who have told us that the value of the report would materially depreciate unless it were published prior to January 1, 1937. All reports for the 1935 Census of Business, except so-called special studies, will be published on or before June 1, 1937. We have gone a long way, therefore, in developing new means of compiling and publishing the results promptly; the principal problem still remaining, of which I have spoken before, is the shortening of the time required for collecting the information. This, I assure you, is receiving adequate consideration on the part of all officials of the Bureau of the Census and in the future we hope to improve the 1935 record by four months.

While discussion of the personnel engaged in the 1935 census may not be appropriate on this occasion, I cannot refrain from giving you a brief picture of the splendid results that have been obtained in an organization which is comprised almost 100 per cent of employees taken from relief rolls. As you are undoubtedly aware, the funds for this census were allotted from the Works Progress Administration appropriation with the understanding that not less than 90 per cent of all persons must be taken from the public relief rolls. These employees work under the same regulations as persons in the regular Civil Service positions of the government.

Today we have in the Philadelphia office approximately 1000 relief employees of whom more than 700 are thoroughly capable. We have been able to train more than 300 card-punch and tabulating machine operators who, I believe, can successfully compete with any similar group in the United States. We have also developed supervisory employees and a large number of typists and clerks. The 1935 Census of Business has, therefore, accomplished a two-fold purpose. It has better equipped several hundred persons to carry on their life work and make an independent living in the future. The claim that these people are qualified to go back into private employment is fully substantiated by the fact that more than 100 have already been so employed. It has also accomplished the purpose of supplying much needed marketing information and recorded for history the degree to which United States business was able to come out of the depression within a two-year period. Either of these accomplishments is, I believe, well worth the $7,500,000 that will have been expended when the project is completed.

VARIATIONS IN PRICE RELATIVE DISTRIBUTIONS, JANUARY 1927 TO DECEMBER 1936

By Leonard Ascher
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The changes in average prices which have occurred in the past few years have been accompanied by drastic alterations in the frequency distributions of price relatives. So revolutionary has been the effect upon these distributions that many of the generalizations previously made concerning the behavior of price relatives are seriously impaired, if not discredited. In support of this contention the distributions for each month, July 1927 to December 1936, are offered here, together with descriptive measures calculated from them.[1]

In the past considerable interest has been shown in this matter of price distribution, with the consequence that several studies have appeared on the subject.[2] From these and other studies certain conclusions have emerged which, in the light of new data, deserve reexamination.

Early investigations of the distribution of prices were animated by the desire to find the mean most appropriate to describe the central tendency. Francis Y. Edgeworth calculated price relatives for twelve commodities covering the years 1782–1820 and 1820–1865, combining them all into one series which was shown by a frequency curve published in his report. This frequency series was positively skew. In his opinion the geometric mean would give the most satisfactory description of such a series.[3] Using a method similar to Edgeworth's, Wesley C. Mitchell arrived at the same conclusion concerning the nature of the distribution of relative prices. He employed 5,578 observations of chain relatives covering a number of years and found a series which was positively skew.[4] This led him to assert:

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[1] Data were secured from United States Bureau of Labor Statistics, *Wholesale Prices*, Washington, 1923–1936. No attempt was made to fill in the gaps which appear in these figures, consequently the number of price relatives in the monthly distributions varies; furthermore, the Bureau has from time to time increased the number of price quotations. However, it does not appear that these defects in the data have influenced the distributions in such a manner that the conclusions presented here are invalid.

[2] Any discussion of price statistics must begin by referring to the comprehensive work of Frederick C. Mills, *The Behavior of Prices*, National Bureau of Economic Research, New York, 1927. Professor Mills analyses the data available in 1927, and reviews the literature on the subject as well, thus providing a most useful summary of the work already done and giving invaluable bibliographical guidance. Another basic work in this field is that of Wesley C. Mitchell, *The Making and Using of Index Numbers*, Bulletin No. 284, United States Bureau of Labor Statistics, Washington, 1921. See also Maurice Olivier *Les Nombres Indices de la Variation des Prix*, Marcel Giard, Paris, 1927. No important study of price dispersion has appeared since 1927, and therefore the consequences of changing the base of the U.S.-B.L.S. price relatives from 1913 to 1926 have not been shown, nor have the effects of the recent depression on price relative dispersion been pointed out.

[3] Memorandum by the Secretary, appended to the "Report of the Committee Appointed for the Purpose of Investigating the Best Methods of Ascertaining and Measuring Variations in the Value of the Monetary Standard," in the *Report of the British Association for the Advancement of Science*, London, 1887, pp. 254–301, particularly p. 284. However, cf. *idem.*, pp. 286 f.

> For the geometric mean two merits are claimed. First unlike the arithmetic mean, it is not in danger of distortion from the asymmetrical distribution of price fluctuations. Chart 2 shows that in a large collection of percentage variations from the prices of the preceding year, the extreme cases of rise run about twice as far up the scale as the extreme cases of fall run down. *Such a distribution is characteristic of relative prices in general* [italics mine]. Indeed, the case cited is distinctly moderate; most collections of variations covering many years would show a greater difference.[5]

Mitchell's conclusions are open to objection. Like Edgeworth, he combined the figures covering a number of years into one distribution. This procedure tends to obscure the month to month, or year to year, fluctuations. Yet on the basis of this composite distribution Mitchell implies that for any given period price ratios form positively skew distributions, a conclusion which gives support to advocates of the geometric mean. An examination of the monthly data for the period 1927–1936, reveals a large proportion of negatively skewed series for which the geometric mean would give results greatly at variance with the modal or median values. In fact, if the price relatives for the period January 1930 to December 1935 (1926 = 100) are combined into one series, the consolidated distribution exhibits negative skewness. It therefore appears that Mitchell's findings should be qualified to apply only to a limited period. Furthermore, although the geometric mean may be properly employed to average price relatives, the justification for the use of this measure will not be found in the shape of the price relative distribution.[6]

Another subject of extensive investigation has been the tendency of price data to disperse. Much has been made of this feature because change in dispersion is symptomatic of disturbance of relationships within the price structure; furthermore the validity of an average is affected by the degree of dispersion. It is therefore of interest to note the relatively slight variations in the standard deviation, while the logarithmic measure, which Mills has called the index of dispersion, has shown a higher range of fluctuation.[7] Although the geometric mean is the logical choice for averaging percentages, and the index of dispersion is an appropriate measure of deviation to use in conjunction with it, the extreme changes registered by this measure of dispersion suggest a qualification to consider when the geometric mean is employed to represent the central tendency of the distributions presented here.

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[4] Mitchell, *ibid.*, p. 18. Another study by him presents distributions for each year, 1913 to 1918. See *History of Prices During the War*, War Industries Board, Bulletin No 1, Washington 1919.

[5] Mitchell, *Making and Using of Index Numbers*, p. 69.

[6] Olivier could find in the nature of the price distributions he examined no clear justification for the use of the geometric mean. *Ibid.*, pp. 79–154; cf. particularly pp. 150–154 for his conclusions.

[7] The index of dispersion was calculated according to the formula given by Mills, *ibid.*, p. 257. The logarithmic standard deviation employed in this calculation was obtained from the organised frequency distributions, employing the logarithms of the midpoints to represent the items contained within each class.

MEASURES CALCULATED FROM PRICE RELATIVE DISTRIBUTIONS
JULY 1927–DECEMBER 1936
1926 = 100

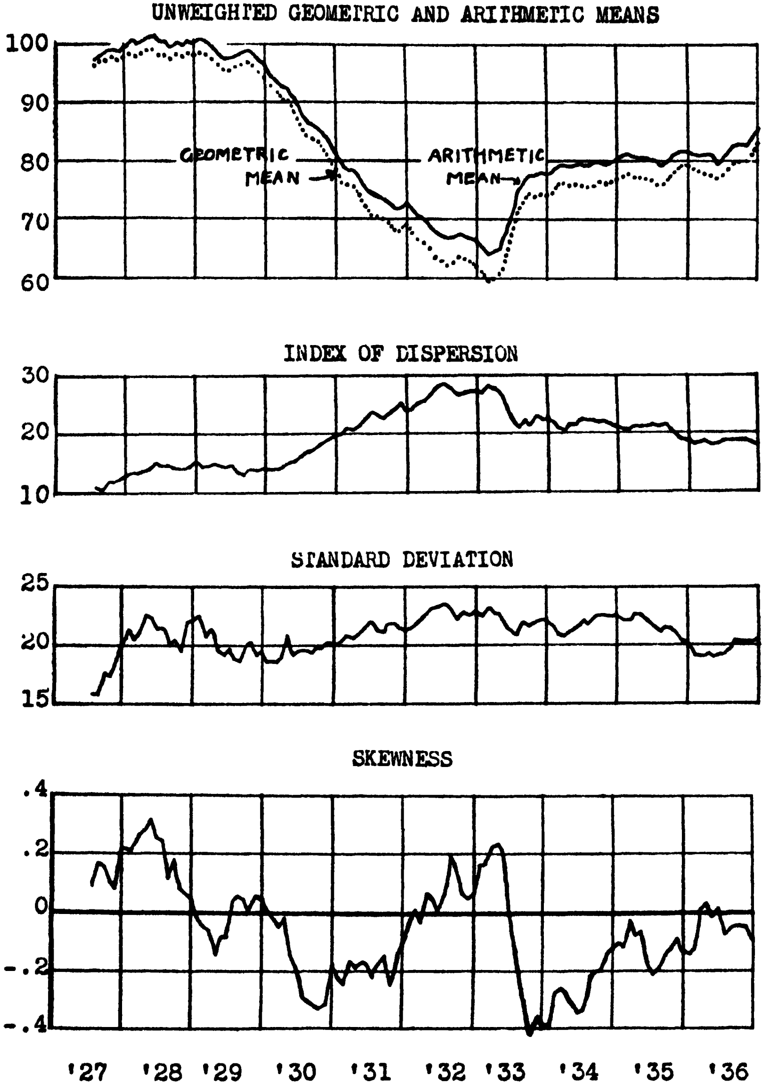

TABLE I
MEASURES CALCULATED FROM FREQUENCY DISTRIBUTIONS OF PRICE RELATIVES, JULY 1927 TO DECEMBER 1936*

	A.M.	G.M.	S.D.	I.D.	Sk.		A.M.	G.M.	S.D.	I.D.	Sk.
1927						1932					
Jan.	—	—	—	—	—	Jan.	71.2	67.4	21.6	24.2	−.034
Feb.	—	—	—	—	—	Feb.	70.4	66.5	22.0	25.2	+.004
Mar.	—	—	—	—	—	Mar.	70.0	65.9	22.5	25.9	−.037
Apr.	—	—	—	—	—	Apr.	69.3	65.0	23.1	26.4	+.065
May	—	—	—	—	—	May	68.1	63.5	23.2	27.6	+.045
June	—	—	—	—	—	June	67.4	62.6	23.4	28.3	+.010
July	97.3	96.1	15.8	10.9	+.088	July	66.7	62.1	23.5	28.0	+.060
Aug.	98.2	97.0	15.7	10.5	+.164	Aug.	66.9	62.5	23.0	27.4	+.195
Sept.	98.9	97.4	17.6	11.7	+.148	Sept.	67.6	63.4	22.3	26.2	+.170
Oct.	99.1	97.7	17.4	11.8	+.103	Oct.	67.2	63.0	22.8	26.6	+.067
Nov.	99.1	97.4	18.6	12.6	+.081	Nov.	67.0	62.6	22.7	27.1	+.057
Dec.	99.7	97.9	19.8	13.0	+.221	Dec.	66.2	61.8	22.8	27.4	+.066
1928						1933					
Jan.	100.3	98.4	21.4	13.3	+.216	Jan.	65.1	60.8	22.7	27.3	+.166
Feb.	100.0	98.0	20.6	13.3	+.215	Feb.	64.0	59.4	23.2	28.3	+.168
Mar.	100.5	98.4	21.2	13.7	+.255	Mar.	64.2	59.8	22.9	27.7	+.226
Apr.	101.2	99.0	22.5	14.2	+.269	Apr.	64.9	60.6	22.6	27.1	+.235
May	101.6	99.1	23.3	15.1	+.314	May	67.5	63.9	21.8	24.2	+.198
June	100.2	98.0	21.4	14.8	+.252	June	70.5	67.1	21.4	22.3	+.015
July	100.3	98.0	21.3	14.8	+.240	July	74.5	71.4	20.9	21.0	−.118
Aug.	99.6	97.6	20.0	14.3	+.109	Aug.	76.2	72.7	22.0	22.2	−.221
Sept.	100.4	98.3	20.4	14.2	+.176	Sept.	77.6	74.2	21.6	21.7	−.332
Oct.	100.1	98.1	19.4	14.3	+.077	Oct.	77.4	73.7	22.0	22.7	−.415
Nov.	100.8	98.5	22.0	14.6	+.060	Nov.	77.8	74.2	22.2	22.4	−.359
Dec.	100.6	98.2	22.2	15.2	+.043	Dec.	77.7	74.0	22.3	22.5	−.384
1929						1934					
Jan.	100.8	98.6	22.4	14.5	−.005	Jan.	78.2	74.7	21.6	22.0	−.393
Feb.	100.3	98.2	20.7	14.5	−.041	Feb.	79.1	76.0	21.0	20.7	−.281
Mar.	99.8	97.5	21.2	14.9	−.061	Mar.	79.3	76.2	20.9	20.5	−.262
Apr.	98.6	96.4	19.6	14.7	−.141	Apr.	79.0	75.7	21.2	21.3	−.286
May	97.5	95.5	19.3	14.2	−.081	May	79.3	75.9	21.6	21.5	−.305
June	97.5	95.5	19.6	14.5	−.081	June	79.4	75.8	22.0	22.3	−.340
July	98.1	96.2	18.8	13.4	+.029	July	79.0	75.5	21.8	22.3	−.334
Aug.	98.5	96.6	18.7	13.3	+.058	Aug.	79.5	75.9	22.4	22.1	−.229
Sept.	98.9	96.9	19.9	13.8	+.048	Sept.	79.9	76.4	22 6	22.1	−.201
Oct.	98.3	96.3	20.2	13.9	.000	Oct.	79.6	76.1	22.5	22.1	−.196
Nov.	97.0	95.1	19.2	13.9	+.055	Nov.	79.6	76.2	22.5	21.7	−.140
Dec.	96.2	94.1	19.5	14.2	+.054	Dec.	80.1	76.7	22.7	21.4	−.122
1930						1935					
Jan.	94.7	92.8	18.5	14.2	.000	Jan.	80.6	77.4	22.2	20.6	−.103
Feb.	93.5	91.6	18.5	14.2	−.013	Feb.	81.1	77.8	22.2	20.7	−.115
Mar.	92.1	90.1	19.0	14.6	−.056	Mar.	80.6	77.3	22.6	21.2	−.025
Apr.	92.2	90.0	20.8	15.2	−.015	Apr.	80.6	77.3	22.7	21.1	−.078
May	90.6	88.4	19.3	15.6	−.158	May	80.5	77.1	22.2	21.1	−.068
June	88.8	86.1	19.4	16.3	−.222	June	80.2	76.9	21.6	21.3	−.172
July	86.7	84.3	19.5	17.1	−.292	July	79.4	76.1	21.2	21.2	−.214
Aug.	86.3	83.8	19.4	17.3	−.310	Aug.	79.7	76.3	21.4	21.5	−.196
Sept.	85.8	83.1	19.8	18.5	−.328	Sept.	80.6	77.4	21.4	20.3	−.145
Oct.	84.7	81.9	19.8	18.8	−.327	Oct.	81.3	78.3	21.0	19.6	−.131
Nov.	82.8	79.9	20.2	19.6	−.315	Nov.	81.9	79.1	20.1	18.9	−.091
Dec.	81.5	78.5	20.2	19.8	−.178	Dec.	81.9	79.2	20.0	18.8	−.140
1931						1936					
Jan.	79.5	76.0	20.2	20.0	−.222	Jan.	81.4	78.9	19.1	18.2	−.140
Feb.	78.4	75.8	20.8	21.0	−.249	Feb.	81.1	78.5	19.1	18.3	−.126
Mar.	78.2	75.1	20.6	20.7	−.163	Mar.	80.3	77.7	19.2	18.5	+.005
Apr.	77.1	73.9	20.8	21.4	−.188	Apr.	80.3	77.7	19.1	18.3	+.030
May	75.5	72.0	21.6	22.5	−.178	May	79.7	77.1	19.1	18.4	−.005
June	74.4	70.7	22.0	23.5	−.191	June	80.2	77.6	19.1	18.4	+.006
July	73.9	70.3	21.3	23.1	−.226	July	81.6	78.9	19.5	18.8	−.069
Aug.	73.6	70.0	21.2	22.8	−.180	Aug.	82.6	79.8	20.2	18.8	−.056
Sept.	72.9	69.2	21.8	23.6	−.151	Sept.	82.8	80.1	20.2	18.8	−.045
Oct.	71.9	68.1	21.9	24.2	−.260	Oct.	83.0	80.2	20.2	18.8	−.050
Nov.	71.9	68.0	21.4	25.2	−.153	Nov.	83.9	81.3	20.2	18.1	−.052
Dec.	72.7	69.0	21.3	23.9	−.100	Dec.	85.8	83.1	20.4	18.0	−.087

A.M. Arithmetic Mean
G.M. Geometric Mean
S.D. Standard Deviation
I.D. Index of Dispersion (See Mills, *ibid.*, p. 257)
Sk. Skewness $=3$ (A.M. − Mean)/σ

TABLE II
FREQUENCY DISTRIBUTIONS OF RELATIVE WHOLESALE PRICES†
July 1927 to December 1936

Relative	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1927												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	—	—	—	—	—	—	—	—	—	—	—	—
20.0– 29.9	—	—	—	—	—	—	—	—	—	—	—	—
30.0– 39.9	—	—	—	—	—	—	—	—	—	—	—	—
40.0– 49.9	—	—	—	—	—	—	2	1	1	1	2	1
50.0– 59.9	—	—	—	—	—	—	2	2	6	7	7	9
60.0– 69.9	—	—	—	—	—	—	17	13	15	12	18	17
70.0– 79.9	—	—	—	—	—	—	30	31	28	33	36	32
80.0– 89.9	—	—	—	—	—	—	82	79	81	79	69	74
90.0– 99.9	—	—	—	—	—	—	192	191	167	157	156	162
100.0–109.9	—	—	—	—	—	—	146	146	142	145	148	131
110.0–119.9	—	—	—	—	—	—	25	32	46	51	47	53
120.0–129.9	—	—	—	—	—	—	15	16	26	27	25	26
130.0–139.9	—	—	—	—	—	—	9	8	8	8	8	10
140.0–149.9	—	—	—	—	—	—	3	6	5	5	7	8
150.0–159.9	—	—	—	—	—	—	3	4	3	2	3	3
160.0–169.9	—	—	—	—	—	—	1	—	—	2	2	3
170.0–179.9	—	—	—	—	—	—	1	1	—	—	2	2
180.0–189.9	—	—	—	—	—	—	1	1	2	1	1	1
190.0–199.9	—	—	—	—	—	—	—	—	—	—	—	1
200.0–209.9	—	—	—	—	—	—	—	—	—	—	1	—
210.0–219.9	—	—	—	—	—	—	—	—	—	1	—	—
220.0–229.9	—	—	—	—	—	—	—	—	—	—	—	—
230.0–239.9	—	—	—	—	—	—	—	—	1	—	—	1
1928												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	—	—	—	—	—	—	—	—	—	—	—	—
20.0– 29.9	—	—	—	—	—	1	—	1	—	1	—	—
30.0– 39.9	—	—	—	—	1	2	4	3	4	3	4	6
40.0– 49.9	1	—	1	2	3	3	2	1	1	1	2	2
50.0– 59.9	7	7	8	6	10	5	8	8	9	10	6	5
60.0– 69.9	21	26	22	22	13	14	11	11	9	7	13	13
70.0– 79.9	26	29	32	31	30	31	26	32	29	31	36	36
80.0– 89.9	71	66	69	70	75	81	87	80	72	76	72	74
90.0– 99.9	159	163	155	147	149	152	145	146	154	141	127	128
100.0–109.9	154	150	136	151	145	142	141	153	151	153	151	152
110.0–119.9	37	32	49	36	37	35	40	44	49	47	66	66
120.0–129.9	21	23	22	21	21	21	19	20	13	21	15	15
130.0–139.9	11	12	13	16	20	18	15	11	16	15	14	14
140.0–149.9	10	11	10	9	9	7	12	8	9	15	15	15
150.0–159.9	4	6	7	12	11	9	6	7	4	5	3	3
160.0–169.9	2	1	5	—	2	4	4	3	6	2	2	2
170.0–179.9	4	3	1	3	3	—	2	1	2	—	—	—
180.0–189.9	1	2	1	3	2	—	1	1	1	—	3	3
190.0–199.9	1	—	—	1	1	4	3	2	2	1	1	1
200.0–209.9	1	1	2	1	1	1	—	—	—	—	—	—
210.0–219.9	—	—	1	1	2	—	—	—	—	—	—	—
220.0–229.9	—	1	—	1	1	—	—	—	—	—	—	—
...	...	...	...	...	...	...	...	...	...	...	...	...
270.0–279.9	1	—	—	—	—	—	—	—	—	—	—	—
...	...	...	...	...	...	...	...	...	...	...	...	...
300.0–309.9		—	—	—	—	—	—	—	—	—	1	1
1929												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	—	—	—	—	—	—	—	—	—	—	—	—
20.0– 29.9	—	1	1	1	1	1	—	—	—	—	—	—
30.0– 39.9	2	2	2	2	—	2	—	1	1	1	4	4
40.0– 49.9	5	4	2	4	6	3	4	3	3	2	—	1
50.0– 59.9	6	7	12	10	8	8	10	8	8	8	7	7
60.0– 69.9	12	15	17	17	20	21	23	19	21	23	21	30
70.0– 79.9	40	30	28	36	42	41	26	29	30	44	50	48
80.0– 89.9	66	72	79	76	76	79	80	80	82	78	88	88
90.0– 99.9	122	127	120	124	139	135	151	151	137	129	148	159
100.0–109.9	160	150	151	159	154	157	144	149	151	146	133	119
110.0–119.9	63	71	63	49	42	38	42	34	37	42	40	39
120.0–129.9	22	31	23	17	17	17	16	19	21	22	18	18
130.0–139.9	17	10	12	18	8	10	14	16	20	19	18	13
140.0–149.9	13	7	11	8	7	3	7	8	8	7	5	10
150.0–159.9	1	2	2	3	5	6	4	3	1	—	2	2
160.0–169.9	—	—	—	—	1	3	1	1	1	1	1	—

(1929 continued on next page)

TABLE II (*Continued*)

Relative	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
170.0–179.9	—	—	1	1	1	1	2	1	—	1	—	—
180.0–189.9	1	1	2	1	1	1	1	2	3	2	2	1
190.0–199.9	3	2	—	1	1	1	—	—	—	—	—	2
200.0–209.9	—	1	1	—	—	—	—	—	—	—	1	—
210.0–219.9	—	—	—	—	—	—	—	—	—	—	—	—
220.0 229.9	—	—	—	—	—	—	—	—	—	—	—	—
230.0–239.9	—	—	—	—		—	—	—	1	—	—	—
240.0–249.9	—	—	—	—	—	—	—	—	—	—	—	—
250.0–259.9	—	1	—	—	—	—	—	—	—	1	—	—
260.0–269.9	—	—	1	—	—	—	—	—	—	—	—	—
...	...	...	...	...	...	...	...	...	...	...	...	...
330.0–339.9	1	—	—	—	—	—	—	—	—	—	—	—
1930												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	—	—	—	—	—	—	—	—	3	3	3	3
20.0– 29.9	1	—	—	1	3	3	3	3	—	—	1	1
30.0– 39.9	3	4	4	3	1	2	1	2	3	1	3	6
40.0– 49.9	1	2	2	3	6	6	21	20	19	23	25	27
50.0– 59.9	12	15	15	11	13	18	19	23	29	42	51	51
60.0– 69.9	22	20	40	44	49	62	60	59	57	48	49	51
70.0– 79.9	53	64	62	59	68	74	69	66	67	70	81	109
80.0– 89.9	111	116	112	115	109	104	114	115	115	120	114	104
90.0– 99.9	146	143	144	150	145	135	133	128	130	124	108	108
100.0–109.9	117	115	99	93	103	94	88	88	84	77	78	66
110.0–119.9	45	33	31	32	19	24	18	19	17	17	17	17
120.0–129.9	12	14	17	14	12	10	8	8	11	10	6	4
130.0–139.9	13	10	10	10	11	7	5	4	1	1	1	3
140.0–149.9	5	4	3	1	—	1	—	—	1	—	—	—
150.0–159.9	1	2	1	2	2	—	2	1	1	1	—	—
160.0–169.9	—	—	—	—	1	2	—	—	—	—	—	—
170.0–179.9	—	—	—	—	—	2	—	—	—	—	—	—
180.0–189.9	—	—	—	—	1	—	—	—	—	—	—	—
190.0–199.9	2	2	2	2	1	—	1	1	1	1	1	1
200.0–209.9	—	—	—	—	—	—	—	—	—	—	—	—
...	...	...	...	...	...	...	...	...	...	...	...	..
300.0–309.9	—	—	—	1	—	—	—	—	—	—	—	—
1931												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	2	2
10.0– 19.9	3	3	3	3	4	5	4	3	3	3	2	1
20.0– 29.9	1	1	1	4	5	4	5	4	7	9	6	9
30.0– 39.9	6	14	15	14	13	19	23	28	29	30	26	40
40.0– 49.9	32	32	28	26	37	45	44	47	48	59	56	67
50.0– 59.9	52	59	54	73	86	84	75	61	65	64	67	82
60.0– 69.9	73	67	79	70	64	61	71	86	81	66	82	134
70.0– 79.9	92	94	98	95	91	93	89	86	95	101	91	128
80.0– 89.9	113	110	104	103	102	95	105	102	95	96	96	133
90.0– 99.9	91	88	91	86	78	73	67	72	66	59	60	95
100.0–109.9	61	57	55	53	48	50	50	42	43	44	40	51
110.0–119.9	9	11	8	7	8	7	5	7	7	5	7	11
120.0–129.9	4	2	3	1	1	3	2	1	1	1	1	1
130.0–139.9	2	2	2	4	3	1	1	1	—	1	—	—
140.0–149.9	1	1	1	—	1	1	—	—	—	—	—	—
150.0–159.9	—	—	—	—	—	—	—	—	—	—	—	—
160.0–169.9	—	—	—	—	—	—	1	—	—	—	—	1
170.0–179.9	—	—	—	—	—	—	—	1	2	1	1	—
180.0–189.9	—	—	—	—	—	—	—	—	—	—	—	—
190.0–199.9	1	1	1	1	1	1	—	—	—	—	—	1
1932												
0.0– 9.9	2	3	3	3	3	3	3	4	3	3	3	3
10.0– 19.9	1	1	1	—	1	3	2	—	1	—	—	—
20.0– 29.9	8	7	10	16	26	25	23	21	15	21	25	28
30.0– 39.9	47	47	55	51	55	70	71	54	57	60	64	71
40.0– 49.9	67	85	81	108	106	96	111	117	100	104	91	94
50.0– 59.9	117	112	111	93	100	100	106	126	126	109	123	120
60.0– 69.9	117	118	112	123	114	112	101	103	122	124	111	113
70.0– 79.9	129	122	124	105	97	100	106	99	107	118	112	111
80.0– 89.9	114	112	109	111	117	114	108	105	101	101	109	107
90.0– 99.9	93	91	91	92	84	79	73	73	74	70	72	68
100.0–109.9	43	40	40	41	40	41	38	39	37	35	34	34
110.0–119.9	12	13	12	11	13	10	12	12	10	10	10	10
120.0–129.9	1	1	2	1	1	2	2	1	2	2	1	1
130.0–139.9	—	—	—	—	—	—	—	—	—	—	—	—

(*1932 continued on next page*)

TABLE II (*Continued*)

Relative	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
140.0–149.9	—	—	—	1	—	—	—	—	1	—	—	—
150.0–159.9	2	1	1	1	1	1	—	—	—	—	—	—
160.0–169.9	—	1	—	—	—	—	—	—	—	1	—	—
170.0–179.9	—	—	—	—	—	—	—	—	—	—	—	—
180.0–189.9	—	—	1	—	—	—	1	1	1	1	1	1
190.0–199.9	1	1	1	2	1	1	1	1	1	1	1	1
1933												
0.0– 9.9	3	3	3	3	1	—	—	—	—	—	—	—
10.0– 19.9	—	2	2	1	4	4	3	3	3	3	3	2
20.0– 29.9	27	31	24	28	19	7	4	5	5	9	7	8
30.0– 39.9	75	88	82	58	38	42	26	30	24	28	29	28
40.0– 49.9	107	110	124	123	79	66	58	61	53	52	48	67
50.0– 59.9	126	118	121	135	156	116	91	84	82	85	82	64
60.0– 69.9	110	107	103	103	145	144	114	87	92	82	83	83
70.0– 79.9	109	105	110	118	128	156	165	143	125	117	124	123
80.0– 89.9	97	96	91	92	99	117	156	164	177	177	179	171
90.0– 99.9	61	56	57	52	54	65	85	94	108	114	115	121
100.0–109.9	33	33	33	32	32	36	44	65	65	66	63	67
110.0–119.9	10	10	10	10	11	12	15	19	23	21	22	22
120.0–129.9	1	1	1	2	1	1	1	5	4	5	6	5
130.0–139.9	—	—	—	1	1	1	2	1	2	3	4	3
140.0–149.9	—	—	—	—	—	—	—	1	1	3	2	2
150.0–159.9	—	—	—	—	—	—	—	—	—	—	—	—
160.0–169.9	—	—	—	—	—	—	—	—	1	—	—	—
170.0–179.9	—	—	—	—	—	—	—	—	—	—	—	—
180.0–189.9	1	1	1	1	1	1	1	1	1	—	1	1
190.0–199.9	1	1	1	1	1	1	1	2	1	1	1	1
200.0–209.9	—	—	—	—	—	—	—	—	—	—	—	—
210.0–219.9	—	—	—	—	—	—	—	—	—	—	—	—
220.0–229.9	—	—	—	—	—	—	1	—	—	—	—	—
230.0–239.9	—	—	—	—	1	—	—	—	—	—	—	—
240.0–249.9	—	—	—	—	—	1	—	—	—	—	—	—
1934												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	2	1	1	1	1	3	4	4	4	3	1	1
20.0– 29.9	9	9	9	10	11	11	9	8	8	13	14	13
30.0– 39.9	23	15	12	14	17	20	21	22	22	17	18	14
40.0– 49.9	58	42	44	56	50	42	40	35	30	35	36	39
50.0– 59.9	68	86	78	67	73	71	75	67	64	56	59	56
60.0– 69.9	90	89	98	90	87	93	96	108	111	117	105	109
70.0– 79.9	119	127	125	130	123	112	115	122	122	127	142	137
80.0– 89.9	179	172	171	167	164	180	174	163	168	168	167	176
90.0– 99.9	123	123	122	120	130	123	122	127	126	124	117	110
100.0–109.9	70	76	78	81	80	80	80	77	77	73	72	75
110.0–119.9	22	22	22	19	21	21	21	23	21	22	25	24
120.0–129.9	5	7	7	7	9	7	6	6	7	9	6	9
130.0–139.9	5	5	5	5	4	5	4	4	6	3	6	5
140.0–149.9	1	1	1	1	2	3	2	3	2	2	2	4
150.0–159.9	—	—	—	—	—	1	1	—	—	1	1	—
160.0–169.9	—	—	—	—	—	—	—	—	1	—	—	—
170.0–179.9	—	—	—	—	—	—	—	—	—	—	—	1
180.0–189.9	—	—	—	—	—	—	—	—	—	—	—	—
190.0–199.9	1	1	1	1	1	1	1	1	1	1	1	1
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
250.0–259.9	—	—	—	—	—	—	—	1	—	—	—	—
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
270.0–279.9	—	—	—	—	—	—	—	—	1	1	1	1
1935												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	—	—	1	—	—	2	1	2	—	—	—	—
20.0– 29.9	12	12	12	14	15	12	13	12	10	9	6	6
30.0– 39.9	13	15	13	12	12	13	19	19	20	16	17	17
40.0– 49.9	39	34	35	36	34	31	29	31	26	25	21	24
50.0– 59.9	51	53	57	54	56	70	71	64	59	48	48	44
60.0– 69.9	99	94	103	113	112	104	102	107	108	123	105	101
70.0– 79.9	147	143	151	135	140	127	135	134	135	129	146	140
80.0– 89.9	178	186	163	177	171	177	174	171	172	169	172	182
90.0– 99.9	110	108	106	102	106	110	113	118	125	136	133	137
100.0–109.9	77	79	78	74	68	68	71	72	71	77	76	71
110.0–119.9	29	31	31	32	33	32	26	25	25	21	27	24
120.0–129.9	7	7	9	10	14	14	11	12	13	12	13	15
130.0–139.9	4	5	8	6	8	6	4	3	4	5	4	4

(*1935 continued on next page*)

TABLE II (*Continued*)

Relative	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
140.0–149.9	4	3	1	2	—	1	1	2	1	1	1	1
150.0–159.9	—	—	—	1	1	1	—	—	—	—	—	1
160.0–169.9	—	—	1	1	—	—	—	1	1	1	1	—
170.0–179.9	—	1	—	—	—	—	—	—	—	—	—	—
180.0–189.9	—	—	—	—	—	—	—	—	—	—	—	—
190.0–199.9	1	1	1	1	1	1	1	1	1	1	1	1
200.0–209.9	—	—	—	—	—	—	—	—	1	—	—	—
210.0–219.9	—	—	—	—	—	—	—	—	—	1	—	—
220.0–229.9	—	—	—	—	—	—	—	—	—	—	—	—
230.0–239.9	—	—	—	—	1	—	—	—	—	—	—	—
...	...	...	...	...	...	...	...	...	...	...	...	...
270.0–279.9	—	1	—	1	—	—	—	—	—	—	—	—
280.0–289.9	1	—	1	—	—	—	—	—	—	—	—	—
1936												
0.0– 9.9	—	—	—	—	—	—	—	—	—	—	—	—
10.0– 19.9	—	—	—	—	—	—	1	1	1	—	—	—
20.0– 29.9	4	6	6	6	7	8	7	6	6	8	2	2
30.0– 39.9	19	16	17	16	14	11	10	9	9	11	17	13
40.0– 49.9	19	21	23	22	24	26	28	26	28	24	18	23
50.0– 59.9	50	50	54	55	47	43	45	49	44	45	51	45
60.0– 69.9	103	105	106	102	144	131	96	88	84	81	75	59
70.0– 79.9	148	153	175	182	153	163	161	151	155	159	149	134
80.0– 89.9	182	181	163	163	162	167	194	196	195	180	176	175
90.0– 99.9	129	126	114	114	115	113	115	128	127	142	152	161
100.0–109.9	75	73	72	70	66	67	68	66	72	70	72	94
110.0–119.9	23	23	22	24	24	23	27	30	33	31	36	37
120.0–129.9	13	12	13	10	8	9	14	14	11	14	13	19
130.0–139.9	2	2	3	4	5	5	7	5	3	4	6	6
140.0–149.9	2	2	1	1	1	2	2	2	5	4	6	6
150.0–159.9	—	—	—	—	—	—	—	1	—	2	1	1
160.0–169.9	—	—	—	—	—	—	—	1	—	—	—	—
170.0–179.9	—	—	—	—	—	—	—	2	3	—	1	—
180.0–189.9	—	—	—	—	—	—	—	—	—	1	—	1

† Taken from United States Bureau of Labor Statistics, Bulletins on Wholesale Prices. Wherever possible data were tabulated from the Bulletin for the month following; e.g., data for July 1929 was taken from the August 1929 Bulletin. However, November 1929 statistics were secured from the publication for the year following. Recently the Bureau has published the data only in the June and December *Bulletins*.

It has been asserted that the rise or fall of average prices has certain effects upon the degree of dispersion. When prices are rising the dispersion is greater; when they fall the price relatives are "squeezed" into a narrower compass and the dispersion is less marked.[8] Mills tested this generalization and concluded that "The results of the present study show that there is a connection between price dispersion and changes in the price level, but there does not appear to be such a simple and direct relation as that suggested by the authorities quoted."[9] The recent data indicate that *if* there is any relation between the degree of dispersion and changes in the price level it is far from being a simple and direct one. In fact an inspection of the charts showing the measures calculated from the monthly distributions for the period following 1930 might lead one to conclude that falling prices mean higher dispersion, and rising price averages bring a closer concentration of price relatives about their means. This is exactly contrary to the thesis mentioned above.

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[8] Mills, *ibid.*, pp. 279 f., reviews the ideas on this point held by Wesley C. Mitchell, Francis Y. Edgeworth, Norman Crump and Lucien March. Cf. also G. Udny Yule's discussion of A. W. Flux's paper in the *Journal of the Royal Statistical Society*, Vol. LCCCIV (1921), p. 201.

[9] Mills, *ibid.*, p. 280. For a more complete understanding of Mills' position in regard to dispersion of price relatives and the price level, consult his "Post-War Prices and Pre-War Trends," in this JOURNAL, Vol. 23 (March, 1928, Supplement), pp. 45–67.

With respect to skewness, there appears to be no consistent tendency. Mitchell's statement that positive skewness is characteristic of price relative series has already been quoted.[10] However, in the distributions for the period following 1927 negative skewness is more common than positive. Irving Fisher has pointed out that there is as much reason for negative as positive skewness, because a positively skewed distribution becomes negative when the base is reversed.[11]

One questionable statement has frequently appeared concerning the skewness of price relative series. It is that such distributions are positively skew because there is no upper limit to the possible rise in prices, but the lower limit of price change is zero. So frequently is this statement encountered in the literature of index numbers that specific citations should be unnecessary. Furthermore, this reasoning is sometimes employed to explain the "geometric" character of price relative series. However, if prices can rise indefinitely, but can fall only to zero, what is to prevent a large number of individual prices from rising, thus putting the bulk of the numbers in the higher values and imparting a negative skewness to the distribution? Furthermore, why should the asserted tendency for prices to rise disproportionately result in a series which will distribute symmetrically if plotted on semi-logarithmic co-ordinate paper? If valid answers to these questions are to be found, one must go behind the price quotations to the forces which affect the movement of prices.

Another contention which cannot survive criticism is that during periods of rising prices skewness tends to be negative, while during price recessions positive skewness is the rule.[12] Mills found no justification for this assertion, and the results of the present study indicate no definite relationship between the direction of skewness and the direction of price changes.[13]

In conclusion, it may be reiterated that very few generalizations concerning the behavior of price relatives can be made with assurance.

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[10] See p. 272, *supra*.

[11] *The Making of Index Numbers*, Houghton Mifflin Co., Boston and New York, 3d rev. ed , 1927, pp. 408–410.

[12] Alfred W. Flux, "The Measurement of Price Changes," in the *Journal of the Royal Statistical Society*, Vol. LCCCIV (1921), p. 190, quoted in Mills, *ibid.*, pp. 337 f. G. Udny Yule, in discussing Flux's paper, stated that tabulations which he had made gave symmetrical series except for years of sharply rising prices when positive skewness was found. *Ibid.*, p. 201. Yule's tabulation of Sauerbeck's data are shown in a chart published in the *Statist*, Jan. 26, 1924, p. 115.

[13] The formula used here to describe skewness is $Sk = 3(M - Md)/\sigma$.

This investigation reveals that for the period covered the distributions are bell-shaped, but otherwise they exhibit remarkable aberrations. They appear to follow no rules so far as skewness is concerned, and the dispersion of the price relatives is so greatly at variance with some previous investigations that valid generalizations which will apply to all periods of price history are difficult to find. However, the negative conclusions obtained in this study indicate the necessity of going behind the price statistics to the economic forces which act upon prices to produce such marked variations between distributions.

A GRAPHIC METHOD OF MEASURING SEASONAL VARIATION[1]

By William A. Spurr
University of Nebraska

The methodology of measuring seasonal variation has been improved in recent years by the development of more accurate though elaborate methods, but little has been done toward the simplification of procedure for the purpose of saving labor. The usual task of gauging seasonal movement, however, is extensive rather than intensive, requiring comparative accuracy with a reasonable economy of effort. The solution is necessarily approximate, even when precise methods are used, both because non-seasonal elements are indeterminate and because the weather and customs which produce seasonality are themselves variable.

The writer believes that the seasonal problem may be simplified by substituting graphic measurement for numerical computation in all or some of the steps involved, in order to save time without sacrifice of accuracy. The method described here permits the direct measurement or elimination of the seasonal element of a time series on a chart using no figures, and with only a pencil and several strips of paper as equipment. This device may also be used to eliminate seasonality and trend simultaneously, thus reducing a curve to its cyclical and random elements in one operation. Much time is saved, since computation is eliminated. In the hands of a skilled operator the degree of accuracy approximates that of analogous numerical methods, the errors of graphic estimation being largely or wholly offset by the advantages of the diagram analysis and the averaging process employed.

The procedure may be summarized as follows. First, a non-seasonal base line is drawn on the chart. This may be a trend or trend-cycle curve,[2] or one of the alternatives noted under (2) below. Then (for monthly data) the ratio of each January's actual value to its non-seasonal value, as determined by this line, is measured[3] by marking off the graphic interval on a paper edge, and a geometric mean taken of the central group of all such ratios.[4] This mean, when adjusted to average 100 per cent for the twelve months, represents the January index of seasonal variation. If the January ratios fail to cluster, but tend to drift through the years, a smooth curve is drawn through their plotted values to secure a progressive measure of seasonal variation. The January data may then be corrected either for seasonal variation alone or for seasonal and trend movements together, by marking the appropriate distances on the chart from the paper strips. Other months are treated similarly.

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[1] The writer is indebted to Professor F. C. Mills for criticism and suggestions concerning this method.

[2] Cf. King's "preliminary cycle curve": King, W. I., "An Improved Method for Measuring the Seasonal Factor," This Journal, Vol. 19 (Sept. 1924), pp. 304–307.

[3] Falkner, H. D. "The Measurement of Seasonal Variation," This Journal, Vol. 19 (June 1924), pp. 171–179.

[4] This type of average is somewhat similar to Kuznets' "positional arithmetic mean," but is reached by a different process. Cf. Kuznets, Simon, *Seasonal Variation in Industry and Trade* (New York, 1933), pp. 28, 31–33.

This method may be used in its skeleton form for rough and rapid seasonal measurement, or in more refined form if greater accuracy is required. The optional refinements include greater care in the selection of a base line, adjustment of seasonal indexes to average 100 per cent, the use of diagram charts for each month, and final checking by means of annual calendar charts. Each operation may be altered to fit the needs of a particular case, since graphic expedients may be borrowed from almost any numerical method. Conversely, numerical computation may be sustituted for any graphic step which appears faulty.

The procedure involves five steps:

(1) The series is plotted on semi-logarithmic paper. The use of this scale implies two assumptions: first, that seasonal variation tends to be more stable as a ratio than as an absolute amount; and second, that the use of ratios is preferable to that of absolute quantities in its computation.[5] In case the reverse is found to be true, arithmetic paper may be used instead.

(2) A smooth line of central tendency is fitted to the series. This may be:

(a) A trend line of any type, either drawn free-hand or mathematically fitted by least squares. The latter is more laborious but more accurate than the former.

(b) A free-hand "trend-cycle" curve (resembling a smoothed twelve-month moving average) following not only the trend but also cyclical and random movements of more than a year's duration. The fitting of this curve involves a subjective error,[6] but its use as a base removes most of the cyclical distortion from the monthly seasonal relatives. The trend-cycle curve is therefore preferable to the trend line if the cyclical movement of a series is pronounced.

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[5] Hall, L. W. "Seasonal Variation as a Relative of Secular Trend," This JOURNAL, Vol. 19 (June 1924), pp. 156–166.

[6] This error cancels out either if the average level of the free-hand curve is too high or too low (since the seasonal indexes are adjusted to average 100 per cent), or if its positive and negative errors are equal (since the ratios for each month are averaged). The residual error may be minimized by: (1) breaking the trend-cycle curve at points of abrupt change, omitting erratic months; and (2) adjusting so that the areas formed above and below the curve appear equal in each year.

The moving average itself often involves a large error, since it fails to reach the peaks, valleys, and extremities of a series, and, unlike the free-hand curve, distorts the 11 or 12 months adjacent to a point of abrupt change. The Federal Reserve Board now uses the free-hand curve for industries showing abrupt non-seasonal shifts (*Federal Reserve Bulletin*, Dec. 1936), but checks this curve against a twelve-month moving average. The use of a free-hand curve alone is of course less precise than the use of both curves, but saves much labor.

While the use of a trend or trend-cycle curve is assumed in the following discussion for the sake of simplicity, certain alternatives may be used instead:

(c) Horizontal lines representing annual averages.
(d) Horizontal lines drawn at the average level of complete cycles.
(e) Any horizontal line on the chart. (This corresponds to the method of absolute monthly means.)
(f) A graphic application of the link-relative method, described in footnote 9, which obviates the use of any such line.

The choice of a base line depends on the same critieria as in corresponding numerical methods. The most accurate base is that which best portrays the non-seasonal elements of the data.

(3) A strip of paper, roughly bisected by a dotted or colored line, is placed vertically on the chart with its edge on the January point of the first year, and its dotted line on the line of central tendency, as shown in Figure 1. The January position is then marked on the edge of the paper strip, as shown by the arrow. The same is done with the other Januaries, the dotted line being placed in each case on the line of central tendency. Now examine the strip (Figure 2) horizontally. The linear distance from each point to the dotted origin represents the ratio of a January value to its "normal" value. The numerical magnitude of the ratio can be read directly from the logarithmic scale of the chart, if desired. The accuracy of chart plotting and reading, in the case of one-cycle paper ten inches high (such as Keuffel and Esser No. 358–50) is within one part in about 1000. Each point has obviated a division calculation on computing machine or slide rule, with its concomitant tabulation of figures.

The scatter diagram of points on the paper strip shows the distribution of January ratios, arranged in order of magnitude, in their correct geometric proportion. This visual device takes the place of the multiple frequency table, whose positional accuracy is comparable to that of letters in the pigeon-holes of a hotel clerk's letter-box. The linear diagram also brings into relief the peculiarities of the seasonal movement. If the points (which may be numbered chronologically) show a drift along the paper strip, progressive seasonality is indicated. The degree of concentration of points measures the regularity of seasonal movement, and hence the reliability of the seasonal index. Different months may be compared by superimposing the strips.

MEASUREMENT OF AVERAGE SEASONAL VARIATION

First Position

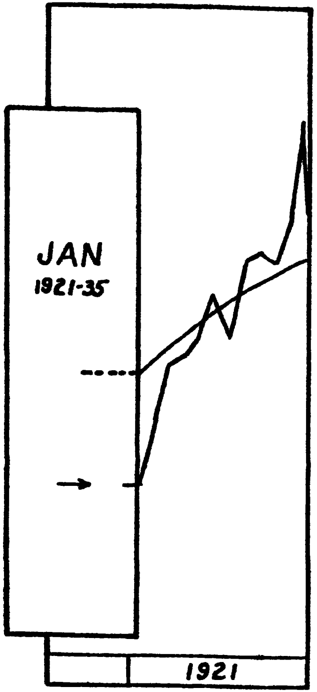

FIGURE 1

Second Position

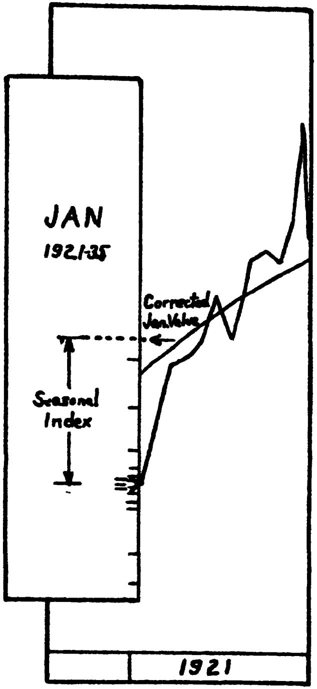

FIGURE 2

PROGRESSIVE SEASONAL MEASUREMENT

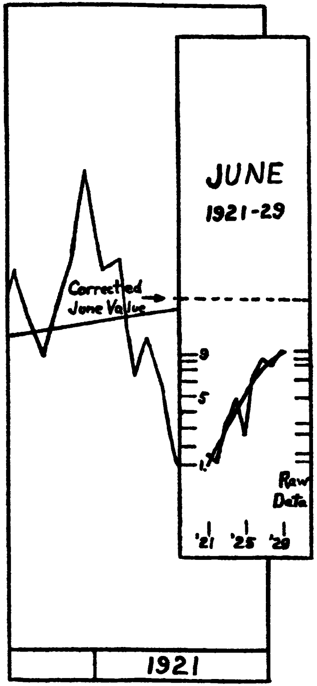

FIGURE 3

TREND-SEASONAL ELIMINATION

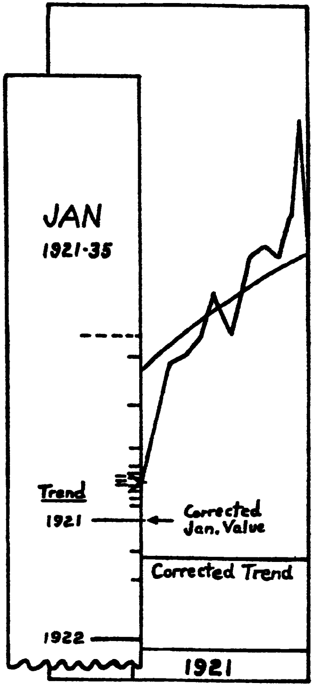

FIGURE 4

Seasonal characteristics may be brought into still clearer relief by plotting a month's successive values chronologically on a strip, as shown in Figure 3. This device is particularly useful for longer periods, and for detecting and measuring progressive seasonal movement. In this case the strip itself should be a piece of ratio paper, with the years (1921–29) marked across the bottom. A month's successive positions are then marked both on the edge of the strip and on its graph, at the same level. The resulting ratio chart serves the same purpose as arithmetic chart used for each month in other methods, but is drawn directly from the original graph without the use of separate charts or figures.

(4) The values marked on the edge of the strip are averaged by inspection. The geometric mean of the central group of items is used, since this type of average is generally more satisfactory for a relatively small number of items than either the median or the mean alone.[7] Extreme items may be discarded at once by inspection. The eye can then proceed from the median to the mean of 3 or 4 central points, thence to the mean of the whole central cluster. The mean is marked on the strip with a caret, as shown in Figure 2, preferably with colored pencil. This brief operation has obviated all the tabulation and computation necessary in deriving the modified arithmetic or geometric mean by numerical methods.

The geometric linear mean of the central cluster, when selected by a skilled observer, is believed to be more reliable than a typical figure chosen from the arithmetic means of successively increasing numbers of middle items, arranged in a numerical table,[8] because: (a) The items which constitute the central cluster may be better identified from the ladder graph than from the table, particularly if the erratic items are skewed. (b) The geometric mean is theoretically superior to the arithmetic mean in ratio analysis. On the other hand, the visual selection of the geometric mean involves a subjective error which calculation of the arithmetic mean avoids.

The distance between the caret and the dotted origin represents the preliminary index of seasonal variation for January, since the use of a line of central tendency as a base eliminated trend (plus a large part of the cyclical element in the case of the trend-cycle curve), and the averaging of January ratios eliminated most of the cyclical and random residuals remaining. The numerical value of the index may be read, if desired, by placing the strip on the vertical scale of the chart. The interquartile range may also be noted, as a measure of deviation.

The preliminary seasonal indexes will yield a seasonally adjusted

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[7] Mills, F. C. *Statistical Methods* (New York, 1924), p. 327.

[8] Cf. Kuznets, Simon, *ibid.*

curve whose relative shape is correct but whose average level is slightly too high or too low. The level may be restored, if desired, by adjusting the twelve indexes to average 100 per cent. This can be done graphically on a blank sheet of paper crossed with a horizontal line. The origin of the January slip is placed on this line, and the January index marked off vertically. The February index is laid off vertically from the latter point, and so on until the cumulative level of the December index is determined. The distance between this mark and the horizontal line is then divided by twelve, either visually (by bisecting twice and trisecting), or with a ruler. The resulting segment is applied to the caret on each strip and the corrected index marked in a different color. The preliminary indexes may also be adjusted mathematically by multiplying the numerical value of each by the quotient of 1200 over the sum of the twelve indexes, and plotting the results on the strips.

Progressive seasonal variation is best measured by drawing a freehand trend curve through the plotted graph on the strip, and transferring each year's trend value horizontally to the left-hand edge of the strip, as shown in Figure 3. If a graph is not used, the points on the right-hand edge of the strip may be resolved visually into a three-point moving median or mean in the center of the strip, and then smoothed by inspection, with the first and last points added, on the left-hand edge. In either case, the distances between the final points and the dotted origin represent the progressive indexes of seasonal variation for June, subject to optional adjustment so that each year's indexes will average 100 per cent. The seasonally corrected values are then plotted as described under (5) below, except that the No. 1 index must be used for the first year (June 1921 in Figure 3), the second index for the second year, and so on.

The distribution of points for any month may be irregular, showing two or more separate clusters. If this irregularity is known to be due to variable seasonal causes, such as the changing number of working days per month, and not to random factors, the months in each group may be corrected by the mean value of that cluster alone. In this way a correction for irregular seasonal variation is obtained. In case the seasonal character of a series changes abruptly, the curve must be broken at the transition point into segments for separate correction, as in other methods.

(5) The paper strip is finally placed again vertically on the chart, this time with the caret on the first January point. The corrected January position is then marked on the chart opposite the dotted line of the strip. These steps are shown in Figure 2. The effect of this shift is the same as that of dividing the January datum by its seasonal index, and plotting the result. The seasonally adjusted curve may be moved away

from the original curve on the chart, for the sake of clearness, by shifting the dotted line on each paper strip a constant distance up or down before plotting the corrected monthly figures.

The seasonal movement of other months is measured and corrected in the same way on separate edges of the same or other paper strips. The revised curve is then drawn through the resulting points on the chart. This curve retains the trend, cyclical and random elements of the original series, eliminating only seasonal fluctuations.

If traces of seasonal variation still persist, the scatter diagrams of the months in question should be scrutinized to determine whether the line of central tendency and the averages were properly chosen, or whether a progressive correction, multiple average or break-up of the series into segments would improve results. The adjusted series may be retraced on a calendar chart, with each year plotted above the next year, in order to reveal more clearly any trace of seasonal residuals.

A graphic application of the link-relative method may be preferred if seasonal relatives are believed to be more stable when based on the preceding month rather than on a given month's "normal" value.[9] This method eliminates the use of a line of central tendency and achieves a partial cyclical correction by means of chain relatives. However, the calculation of these secondary relatives and their correction for trend makes this process more laborious than the other.

The method of eliminating trend and seasonal elements simultaneously is illustrated in Figure 4. The procedure is the same as that already described, with the addition of a single adjustment for the trend factor. A horizontal line of the chart is chosen as a "normal" about which to plot the adjusted series. The paper strip is placed with its dotted origin on the line of central tendency (Figure 1), and the first January position marked on the strip as before. In case a trend line is used, the strip is not moved while the position of the "normal" line is also marked with a long dash (preferably out of the range of January items), and the year (1921) noted alongside. If a trend-cycle curve is used in plotting the monthly relatives, however, a trend line must be added to the chart and the dotted origin of the strip shifted to this line before the location of the "normal" line is marked. The use of a trend-cycle curve throughout would reduce the adjusted series to its random elements and residual errors alone.

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[9] The link-relative method may be performed graphically as follows: the ratio of each February to the preceding January is measured by setting the paper strip vertically with the central dotted line on the January item, and marking the February position on the strip in pencil. This is done for all the February-January ratios, and the geometric mean of the central cluster is selected as in the other method. The chain relatives are determined on a blank sheet of paper crossed with a horizontal line. Placing the initial January on this line, the January-February mean distance is marked off vertically, and the February point marked. The February-March distance is measured vertically from the latter mark, and so on for 13 months until the second January is located. To correct for trend, the distance between the second January and the base line is divided into 12 equal parts by inspection. The February point is then shifted toward the base line by one of these twelfths, March by two-twelfths, and so on, until the second January is brought to the same level as the first. A horizontal line is next drawn by inspection through the geometric mean of the twelve adjusted points in order to make the average seasonal index equal to 100 per cent. The distances between the adjusted points and this line are finally applied to the plotted data, as in Figure 2, to effect the seasonal correction.

The strip is then moved along the original line of central tendency and marked with the other January values and corresponding trend positions. The geometric mean of the central group of January points (not the trend positions) is selected and indicated by a caret, as before. Then the strip is placed with its caret on the first January item as in Figures 2 and 4. The new value for this month, however, is not marked next to the dotted line of the strip (since this would eliminate only seasonal variation), but next to the adjusted trend position for that year, as shown in Figure 4. The caret is then moved to the January of the second year, the second trend position marked on the chart, and so on. The other months are treated similarly, and a curve drawn through the new series of points. This curve should fluctuate about the selected horizontal line without trend or seasonal bias. The distance between the dotted center and a trend mark on a strip represents the trend ordinate for the month in question, just as the spread between the dotted center and the caret denotes its seasonal index. Hence, the distance between the caret and a trend mark of the strip represents the combined factor of trend and seasonality, and a corresponding shift of the original datum effects this compound correction. The cyclical-random elements of the curve have thus been isolated in virtually a single operation without recourse to computation or tabulation of figures.

To recapitulate, the foregoing method of measuring seasonal variation offers three advantages. The most important is that of labor saving The use of computing machines, tables or figures, as well as subsidiary charts or diagrams, is eliminated. Calculation is reduced to its simplest elements. Each month's value is marked by a positional dash, the dashes are averaged visually, and the resulting seasonal index applied to the data directly on the chart. Trend may be eliminated in the same operation with little expenditure of time. Where clerical help is available, the statistician needs only to draw the line of central tendency (or supervise its computation) and to select the mean of the central cluster on each monthly strip, while an unskilled assistant does the rest.

The second advantage of this method is its accuracy, which is roughly equivalent to that of the analogous numerical methods. The average error of plotting or reading on one-cycle ratio paper is about 0.1 per cent, whereas seasonal measurement is rarely reliable within 1 per cent. The geometric mean of the central group of items, visually selected, is believed to be a reliable type of average. The use of a trend-cycle curve involves a personal error, but reduces cyclical aberration, and draws the monthly relatives closer together, thus reducing the probable error of their mean. The theoretical advantages of averaging ratios to normal values in seasonal measurement are well known,[10] and hence need not be considered here.

The accuracy and computing time of several seasonal methods have been compared by the Statistical Department of the Detroit Edison Company[11] and by Mr. E. Z. Palmer,[12] using a synthetic series with known seasonality. Results are shown below, with the writer's "graphic" method (using a free-hand trend-cycle curve) added in the last row.

Method	Mean deviation from true seasonal, per cent	Mean deviation of monthly arrays, per cent	Computing and checking time, minutes
1. Monthly means	2.0	18.4	60
2. Interpolation	1.7	18.4	110
3. Link-relative	2.0	7.3	160
4. Ratio-to-trend-cycle			
4a. 12 months moving average	1.3	6.2	285
4b. With free-hand correction	0.8	4.9	495
4c. *Graphic*	0.8	4.5	40

This test, while inconclusive, suggests that the free-hand ratio-to-trend-cycle methods are the most accurate, both in the average error of their seasonal indexes (column 1) and in the reliability of the indexes as derived from the monthly arrays (column 2). The graphic method retains the accuracy of its numerical counterpart (4b), but decimates its computing time (column 3).

The third advantage is that of flexibility. Central tendency may be measured by a trend or trend-cycle curve, annual or cyclical averages, a horizontal line, or by chain relatives, whichever is most appropriate. When the values of a given month are marked on a paper strip, the resulting scatter will reveal any peculiarities of seasonal movement—whether progressive, abruptly shifting, irregular, or otherwise distinctive. The appropriate method of correction may then be chosen and carried on from that point, without starting anew. In the final step, seasonality may be eliminated either with or without trend from the series. The graphic medium affords a continual visual check on successive operations, promptly revealing errors in measurement or judgment, and allowing necessary variations of technique. Semi-annual, quarterly and weekly data may be treated in the same way as monthly material.

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[10] Mills, F. C., *op. cit.* pp. 323, 324, 328; Hall, L. W., *ibid.*

[11] "A Mathematical Theory of Seasonal Indices," *Annals of Mathematical Statistics*, Vol. I (1930), pp. 57–72.

[12] "Error and Unreliability in Seasonals," *Annals of Mathematical Statistics*, Vol. I (1930), pp. 345–351. See especially pp. 348–350.

THE CONSTRUCTION OF TWO HEIGHT CHARTS

By May Ayres Burgess
New York City

THIS IS A description of the construction of a pair of Height Charts for American boys and girls which show the distribution of heights at each age and the height curves along which children tend to grow. Hundreds of height studies have been published and many of them have been made under careful scientific guidance. Yet when the parent or teacher or physician wishes to know whether an individual child is shorter or taller than would reasonably be expected, and whether his rate of growth is normal or abnormal, he finds the question difficult to answer. The same child may be regarded as far below average in the light of one study and far above average in the light of another. Whether he ought or ought not to be about where he is is largely determined by the individual opinion of the examiner. What appears to be needed most is not another field study of stature but a merging of the results of many studies to produce a practical device for recording the growth records of children and making judgments concerning their significance.

UTILIZING EXISTING STUDIES

As finally constructed, each of the two new Height Charts, one of which is shown in Diagram 3, consists of a central or 50 per cent line, showing the height of the average American child at each age from 1 to 21 years. Above and below this central line, not quite parallelling it, are other lines for 99 per cent, 90, 80, 70, etc., showing the heights of those children who are so tall that 99, or 90, or 80, or 70 per cent, etc., of all American children of their age are shorter than they. When an individual child's record is plotted on the chart it is therefore possible to note not only whether he is taller or shorter than the average, but what height level he is on as compared with the typical level for his social-economic group, what percentile path he is most closely following, and whether the amount of growth he makes over a given period is the same as, or more or less than, the amount of growth usually made by other children at his level.

The first step in constructing these charts was to determine the values of the central or 50 per cent lines. Some 60 different sets of averages[1] were used in making the study, but not one study reported reliable measurements for every age from 1 through 21 years, and no one of the sets agreed throughout its length with any of the others. Diagram 1 illustrates the nature of the problem. This diagram shows the "average" heights for American boys of different ages as shown by 18 of the studies.[2] Which is the most reliable average for the typical American boy of, say, 10 years? How much does the typical boy grow between the ages of 13 and 14? How tall is he at 21? No one of the available studies could be taken as the sole guide in answering such questions as these.

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[1] See the list, p. 307.

The simple device of combining the results of all the studies by a process of weighted averages could not be used. There were several reasons. The first and rather surprising one was that many otherwise excellent studies fail to state the numbers of cases included in different calculations, or to give any measures for dispersion. Strikingly little information is given as to the social-economic levels of the groups being studied. Moreover, several of the larger and more helpful studies showed evidence of bias in the selection of certain age groups which could not be corrected by any ordinary weighting process.

A new nationwide study of sufficient scope would not only have been expensive and time consuming, but—which was more serious—even a very large and careful study would probably have suffered from many of the weaknesses of its predecessors. To make a thoroughly reliable height study is not easy. Heights must be taken accurately; in most school records they are very inaccurate. Ages must be verified, especially when they are being classified to the nearest month. Large numbers of children must be measured at each age, because so little is known as to what determines variations in growth that it is as yet practically impossible even with elaborate precautions to select a small group of children every one of whom presents a completely normal growth picture. Children who seem alike at one age may a few years later present startling differences, and if the group is small a few such cases may distort the resulting figures. The selection of children must be intelligently inclusive, for until more is known about what constitutes normal growth the statistician should regard critically those studies which say, in effect, "Children so tall or so short as to be obviously abnormal have been omitted from this study."

Fully as important and much more difficult to guard against are the variations from age to age in the social-economic level, which many careful pieces of research have shown to be positively correlated with height.[3] Studies in public school systems, made many years ago, often showed children in the upper grammar grades taller than the records from the lower grades would have seemed to predict. The reason probably was that as they grew older the poor children dropped out of school to go to work. In general poor children are shorter than those

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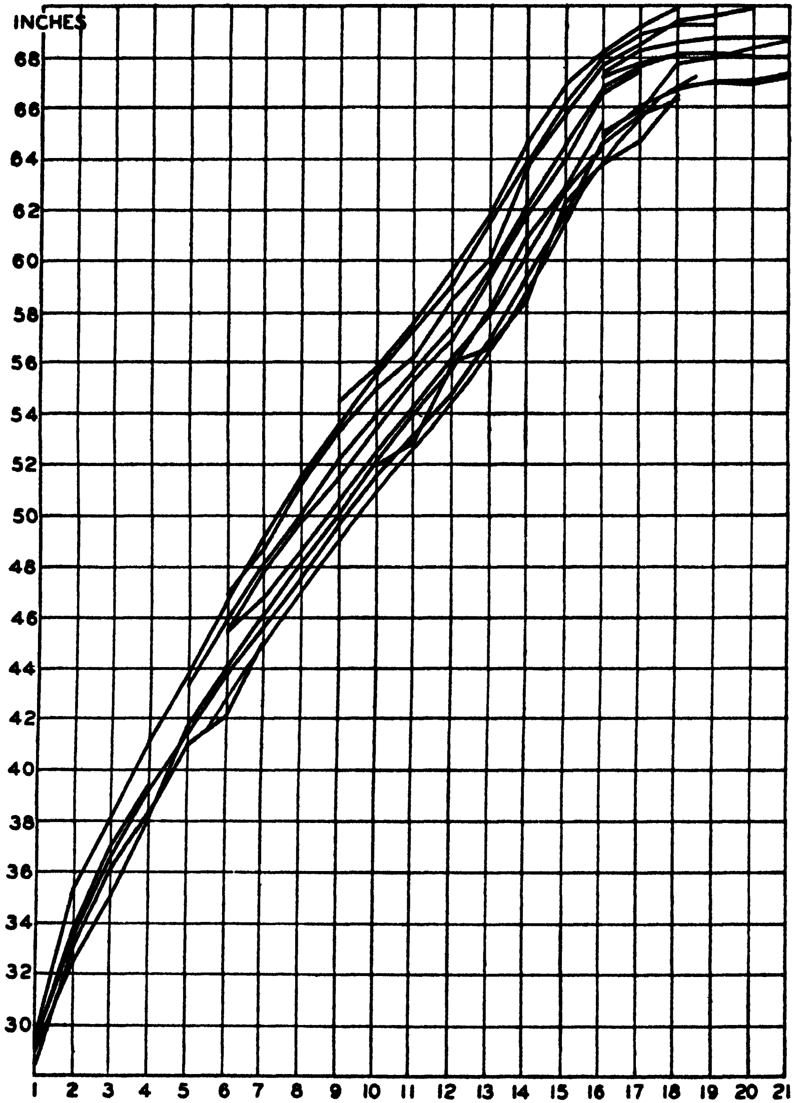
[2] In Diagrams 1 and 2, because of the great amount of overlapping, only studies fairly far apart are shown, and no attempt is made to label the different ones.

[3] For an exceptionally complete digest of these findings for children in different countries, together with full bibliography, the reader is referred to Barkev S. Sanders, *Environment and Growth* (Baltimore: Warwick and York, Inc., 1934).

DIAGRAM 1

AVERAGE HEIGHTS OF BOYS REPORTED BY 18 DIFFERENT STUDIES



whose parents have more money, so that by leaving school they raised the average height for those who remained. Similarly it seems probable that some of the recent figures for heights of private school children have been raised or lowered at different ages by shifts in the average economic level of the pupils. On the higher economic levels the average for five year old school children, and for 16 year old college students is often greater than heights at other ages for the same schools would indicate, probably because the parents tend to hold back short children and push tall children ahead. On the other hand, in thickly populated districts the average heights of five year olds may be low because poor parents hurry their children into school to keep them off the streets.

The difficulty of making any new height study which would avoid all these errors is obvious. It seemed probable that quite accurate results could be secured, not by trying to measure several hundred thousand more children, but by analyzing and combining the best of the already existing studies in such a way that their non-typical figures would be identified and omitted and their typical ones utilized. Some of the 60 studies used were of pre-school children, others of pupils in the grades, others of high school boys and girls, and still others of college students. Measurements were for children of different social and economic levels, for different racial groups, and different geographic locations. Some were for very large numbers of cases and some for very few. Some were for one sex only and some for both. Certain studies were made recently, while much of the most valuable material was gathered more than 40 years ago. There were many evidences of selective bias. Yet in spite of such differences, and in spite of the fact that no two sets of average heights per age were the same, all of these studies showed certain striking characteristics in common. The new charts were constructed by identifying, segregating, and combining those universal attributes.

THE METHOD OF DIFFERENCES

When the averages for the many studies were plotted together on one sheet (as in Diagram 1), although some were high on the scale and others low they all followed essentially the same pattern. Average heights for one year old boys varied, but all of them were less than 32 inches. Average heights for 21 year old boys also varied, but all of them were over 65 inches. Throughout their course, from one to 21 years, the different studies stayed rather closely together; because essentially they were all measuring slightly different manifestations of the same thing, which was growth in human stature. They bore the unmistakable appearance of curves changing according to the dictates of a controlling law.

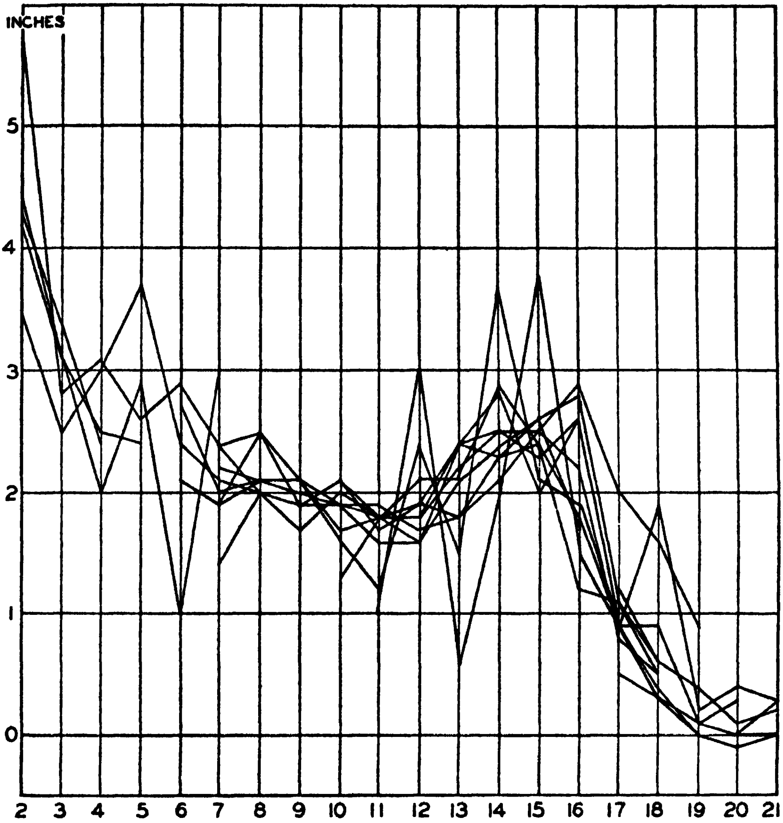
Height curves may be thought of as cumulative lines in which each year's growth is added to the total reached the year before. The pattern which growth is following—whether it is accelerating or diminishing, and how rapidly—may be seen by breaking down each cumulative line into its separate annual increments. If we know that in one famous study the heights of boys from one to five years averaged in inches: 29.4, 33.6, 36.7, 39.2, and 41.6, we are apt to think only of the rapid growth shown by little children. If, however, we break those figures down to show how much growth occurred each year, and find annual increases of 4.2, 3.1, 2.5, and 2.4 inches, what impresses us is the rapidity with which the initial rate of growth decreases. When corresponding figures from other studies are found to be closely similar, we then have a basis for estimating just about how much growth may be expected in the average child every year. Essentially, this was the process followed in building the central tendencies of the new Height Charts.

For each sex the first, second, and third differences (annual increments, differences of increments, and differences of these differences) of the height averages in each of the 60 studies were computed. It might have been possible by some process of weighting to combine these 60 lines directly into one master line. As has already been pointed out, however, so many of the studies failed to give full information concerning the methods by which the data were gathered that proper weighting seemed out of the question. Moreover, there were certain important accidents in selection which would not have been caught by the smoothing process. Each of the three set of differences was plotted in a master diagram. Most of the differences, being approximately true ones, were so nearly identical that they clustered closely together in the diagram, often within an area representing only half an inch of growth, but differences which had been derived from nonrepresentative measurements, either for a single year or for a long series of years, stood strikingly apart from the others. The points representing the great bulk of the studies fell into a narrowwinding stream or track which could be followed rather clearly from year to year. The data from the great majority of height studies fell within its narrow boundaries and defined its course. Evidences of selective bias in the studies were made conspicuous by the way in which data derived from them departed from the common path. This is illustrated by Diagram 2 showing yearly increments, or first differences, of the average statures of boys. For clearness, only 18 of the 60 studies in the master diagram are shown. The distinctive pattern can be clearly seen. In this way it was possible, by disregarding the few abnormal differences, to locate for each diagram a trend line representing the central tendency of what the differences would have been had all the studies been free from selective error.

DIAGRAM 2

AVERAGE ANNUAL INCREMENT IN HEIGHTS OF BOYS IN 18 DIFFERENT STUDIES

Increase from average height of preceding year



The first, second, and third differences of average heights for boys and girls yielded six master diagrams. In addition there were two other master diagrams which were of major importance because they checked and controlled the other six. They were the diagrams showing the differences between the averages for boys and the averages for girls at each age and the differences of these sex differences. While boys and girls show typical patterns of growth, their patterns are not the same yet in the comparison, certain accidents of measurement which might not have been detected when the sexes were treated separately were brought strikingly to light and the streams or paths of differences which characterized the first six master diagrams were subjected to an additional check and verification. Space does not permit reproduction even in abbreviated form, of all eight master diagrams in this article.

The plan for constructing two theoretical lines of average heights, one for boys and one for girls, was to find the central trends of the 60 studies for each of the eight sets of differences, and then derive from these trends the two lines of average stature. Since all eight had been drawn from a common source, it followed that they all interlocked, so that the change of even one average in one of the basic studies involved corresponding changes in at least five of the diagrams and a change for both sexes meant revisions in every one of the eight. Since this was true for the individual studies, it followed that the true central trend lines for the differences of the eight master diagrams must not only lie within their respective channels and conform to the controlling direction of those channels, but all eight must also show the same interlocking.

To determine the true trend lines called for much careful experimenting. The procedure followed, starting with the third differences and working backward, was to find the marginal limits of the trend at each year in each of the eight master diagrams; locate the mid point value; and then, by a series of approximations, shift the location of each one of these mid points slightly up or down within the limits of its stream until the value of each interlocked with the corresponding values of the other seven.

In so long a series of adjustments, the laboring statistician is comforted by the words of Galton, in his presidential address of 1885 to the Anthropological Institute, where he tells of counting his pedigreed flower seeds from which he discovered the law of regression. He says: "the data ran somewhat roughly and I had to smooth them with tender caution." In the work on the Height Charts also, smoothing with tender caution had at this point to be resorted to.

When the interlocking trend lines for the eight diagrams had at last been identified, two lines were constructed from them, one for the average heights of boys and one for the average heights of girls, at each age from 1 to 21 years. These became the 50 per cent lines in the Height Charts. The figures finally adopted as the trends of first differences, or annual height increments, and for boy heights minus girl heights are shown in the first three columns of Table I. The two columns at the extreme right show the average heights for boys and for girls which form the central tendencies for the Height Charts and which were constructed from these figures.

TABLE I

ANNUAL INCREMENTS AND SEX DIFFERENCES IN HEIGHT AS DERIVED FROM SIXTY STUDIES, AND RESULTING AVERAGE HEIGHTS FOR BOYS AND FOR GIRLS*

Inches

Exact age in years	Annual increments		Difference between sexes	Average heights	
	Boys	Girls		Boys	Girls
1			.35	30.25	29.90
	4.22	4.22			
2			.35	34.47	34.12
	3.20	3.20			
3			.35	37.67	37.32
	2.70	2.70			
4			.35	40.37	40.02
	2.42	2.42			
5			.35	42.79	42.44
	2.24	2.24			
6			.35	45.03	44.68
	2.10	2.10			
7			.35	47.13	46.78
	2.00	2.00			
8			.35	49.13	48.78
	1.92	1.92			
9			.35	51.05	50.70
	1.86	1.94			
10			.27	52.91	52.64
	1.80	2.12			
11			−.05	54.71	54.76
	1.74	2.35			
12			−.66	56.45	57.11
	2.16	2.34			
13			−.84	58.61	59.45
	2.44	1.66			
14			−.06	61.05	61.11
	2.47	1.00			
15			1.41	63.52	62.11
	2.00	.49			
16			2.92	65.52	62.60
	1.19	.16			
17			3.95	66.71	62.76
	.48	.01			
18			4.42	67.19	62.77
	.19	.01			
19			4.60	67.38	62.78
	.07	.01			
20			4.66	67.45	62.79
	.05	.01			
21			4.70	67.50	62.80

* The average height for American boys at 21 years is taken as 67.5 inches. See discussion below.

An additional step was necessary before the averages could be computed. It was to find a starting point. This had to be an arbitrary decision, for at no age is there a completely reliable height average. The figure finally taken, because there was better evidence for it than for any other, was for the height of the average American man on his 21st birthday. With that as a finishing point, the values for the last two columns in the table could readily be determined. No one knows exactly how tall the average American man is. There are few studies for that age, and those that are available do not agree. Were the influence of immigration removed, there is evidence to indicate that the average height of our men would show slight but steady increases from year to year; but these increases are in such large measure offset by the shorter stature of incoming foreigners that the mean stature of the first million draft recruits in the U. S. Army in 1917–18 was almost exactly the same as the mean stature of recruits during the Civil War more than 50 years earlier.[4] This figure, which was 67.5 inches, was therefore taken as proably the safest estimate for the average American man when he reaches voting age today. It may be slightly too low. It is almost certainly not too high. The two sets of height figures were built down from that finishing point.

THE SURFACE OF DISTRIBUTION

Height Charts, to be useful in studying individual growth records for children of different social-economic-geographic levels, must show not only heights at each age for average American boys and girls, but also corresponding figures for the growth curves of children at different levels in the general distribution below and above the average. This means that the forms of the distributions at different ages must be determined. For homogeneous groups of adults the height distribution takes approximately the form of the "normal" or Gaussian curve, but it has been stated by some investigators that for growing children the distributions are not normal but skewed.

Perhaps it is true that at certain ages, especially those of adolescence, the distributions of children's heights are characteristically skewed, but the available evidence is not convincing. When one tries to state for any given year whether the skewness is large or small, positive or negative, the comparison of data from different studies does not give much help in arriving at a decision. Unfortunately most height studies do not publish the facts necessary for determining the shape of the distribution curves; but some idea of the differences in results where the data are available may be gained from the six sets of findings in Table II.

By the familiar formula, "Skewness equals three times the Mean minus the Median, divided by the Standard Deviation," perfect symmetry would have a coefficient of zero and moderate skewness a coefficient of about ±.25. When this formula is applied to the data for heights of adult males born in the British Isles (Yule, C. U., *Introduction to the Theory of Statistics*, p. 88 et seq.), we find that skewness equals .01. As will be seen by inspection of Table II, most of the distributions represented there more nearly approach symmetry than they do moderate skewness. Where the coefficient of skewness is high for a given year in one study the coefficient immediately above or below it, or for the identical year in some other study, may be low. The greatest apparent skewness usually appears in studies where the numbers of children measured are small.

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[4] For discussion of the World War and Civil War figures, see Davenport, C. B. and Love, A. G., *Army Anthropology* (Washington, D. C.: 1921), p. 67 et seq.

TABLE II

COEFFICIENTS OF SKEWNESS FOR AVERAGE HEIGHTS OF BOYS

Age	Woodbury 1 month span	Woodbury 12 month span	Boas	Clark, Sydenstricker, Collins	Burgess	Diehl
1	.08	.11				
2	.06	.04				
3	.05	.05				
4	−.03	−.01				
5	.02*	−.02				
			.06			
6		−.14		.21*		
			.09			
7				−.23*		
			.05			
8				0*		
			.05			
9				0*	−.22*	
			.03			
10				0*	.07*	
			.03			
11				.11*	.02*	
			.03			
12				.20*	−.07*	
			.13			
13				.10*	.25*	
			.12			
14				.08*	.16*	
			.14			
15				−.08*	−.04*	
			−.05			
16				−.30*	.08*	−.21*
			−.24*			
17					−.31*	−.02
			−.04*			
18					−.23*	−.07
			−.13*			
19						0
20						0
21						−.02

Sources; Woodbury, R. M., *Statures and Weights of Children Under Six Years of Age* (U. S. Dept. of Labor, Children's Bureau, 1921). Boas, F., *The Growth of Toronto Children* (U. S. Bureau of Education, 1896, 7. 1898). Burgess, M. A., Unpublished study of the heights of 600 boys in the Riverdale Country School, New York City. Diehl, H., "College men," *Human Biology*, Vol. 5 (Sept., 1933).

* The number of children measured was less than 1,000.

It would be helpful if distribution studies could be made with special emphasis upon securing large numbers of children in homogeneous age groups. If, especially during adolescence when growth is rapid, children could be measured on their birthdays, instead of to the nearest birthday (which may be six months away), or to the past birthday (which may be nearly 12 months away), and if large numbers could be measured at each age, it might be that the skewness shown in some of the studies would largely disappear. Or, if the skewness is real, such a study might show at what ages it occurs and how great it is at each age.

After reviewing the evidence now available, it was decided that for practical measuring purposes the most reasonable assumption is that for either sex at any exact age the heights of children are distributed in something very nearly approaching the normal distribution. A chart based on that assumption may be slightly misleading in its extreme outer ranges, when the measures of dwarfs and giants are being considered, but, in the light of present information, it will probably be less misleading than if skewed distributions for the adolescent period were arbitrarily adopted. The charts were therefore constructed on this basis.

For the growth percentile lines above and below the average it was next necessary to determine the standard deviations at different ages. Unfortunately, many height studies fail to include in their published reports either the frequency distributions for different ages or computed measures of variability. Such data as are available, however, indicate that where the number of cases at each age is sufficiently large and the selection consistently representative the standard deviations of height distributions follow growth patterns much as do the figures for averages. With some modifications made necessary by the relatively small number of studies available, the technique already described for deriving a master series of averages by analyzing the fundamental difference trends of existing studies was also followed in determining the master series of standard deviations.

Until the age of 7½ years, the standard deviations for boys and girls are practically the same. Their yearly increments, like those for averages, are high during the first year and gradually decrease. The downward trend of yearly increments reaches its low at 6½ years, and then starts rather slowly upward for both sexes. The sharp upward adolescent spurt in the standard deviations begins at about 9½ years for girls and at about 10½ years for boys. The high point for girls is reached shortly before the 13th birthday, and the descent from that point is very rapid, so that from the age of 17 the standard deviations of the height distributions for girls have practically reached their final adult level. From 13½ on, the heights of boys are much more variable than those for girls. The top of the boys' adolescent peak does not come until just after the 15th birthday; and the final adult level is just being approached at the age of 21. The standard deviation for the first million

American draft recruits in the World War was 2.71 inches. In making the Height Charts this figure was raised to allow for the extra variation which would have occurred had the Army recruits included men under 59 inches or over 79. It is possible that this figure should be even a little higher; but it should probably not be any lower.

TESTING THE CHARTS AGAINST THE 60 STUDIES

After the lines for average heights and for standard deviations had been constructed they were tested for accuracy in terms of the 60 studies from which they had been drawn. The averages of all the studies available for a given year were translated so that each became a percentile point in a normal distribution determined by the average and standard deviation for that year. At age 10, for example, with the theoretical average for boys at 52.91 inches and the theoretical standard deviation at 2.27 inches, the entries for five of the studies were translated into percentile points as follows:

Study	*Average height*	*Percentile point on Height Chart*
Boas	51.0	20
Holt	52.2	38
Clark, Sydenstricker, Collins	52.6	45
Baldwin Score Card	53.5	60
Gray Ayres	55.6	88
Height Chart, Boys	52.9	50

In theory, if the Charts were properly constructed, any given study should maintain approximately its same percentile position for every year on the Height Chart. If, in the distribution for 10 year old boys the Boas average was at the 20 per cent level and the Gray, Ayres average at the 88 per cent level, we should expect the Boas and Gray, Ayres averages to maintain their positions near 20 per cent and 88 per cent at 5 years, 8, 12, and 15 years. Their percentile positions would change from year to year only (a) if the samplings were so small or so biased as to produce fluctuations, or (b) if the social-economic level of the group being studied shifted—which apparently happens rather frequently, or (c) if the Height Chart itself, in terms of which the percentiles were found, needed adjustment.

Where fluctuations in the percentage levels were due to weaknesses in the studies themselves, such fluctuations would be inconsistent with each other, and would occur at different years and in different directions. But if, for example, one of the averages of the Height Chart were too high at one year, most of the percentages for the different studies would show a drop at that particular year, and would therefore point unmistakably to the error in the average shown on the Chart. By lowering the average, perhaps even so little as one tenth of an inch, the corresponding percentages might be raised and their fluctuations ironed out.

The tables as drawn up covered the averages of all the studies at all the ages, translated in terms of percentile points on the new charts. To test the validity of the theoretical charts, these percentiles were then recomputed to see what they would be at each year if the Height Chart average were raised or lowered. The percentiles shown for the five studies just cited, for example, where the Height Chart average for 10 years was 52.9 inches, were recomputed for possible averages of 52.6, 52.7, 52.8, 53.0, 53.1, and 53.2. Similar tests were made for all the studies at all ages for both sexes.

As a matter of fact, this testing of the theoretical averages against the averages of the 60 studies proved hardly necessary. Surprisingly few adjustments had to be made; but the process did contribute to the writer's confidence in the validity of the work. The averages which were finally adopted and which now appear at the even years along the 50 per cent lines of the two Height Charts are those which, while derived from and conforming to the relationship trends determined in the eight master diagrams of differences, also make for the least variation in the percentile levels of the contributing studies.

The standard deviations were tested in a similar manner. If the tentative average had been a little too high, that fact would have been indicated by a general down dip in most of the percentile values for the several studies, both above and below the 50 per cent line. If, however, the average had been correct but the standard deviation too large, the percentile values of studies near the middle of the distribution would have remained fairly steady, while those near the upper limits would have tended to drop and those near the lower limits to rise at the age in question. The standard deviations finally adopted were those which most nearly controlled such fluctuations in the very high and very low percentile levels, while still conforming to the requirements for the trends of differences.

When the averages and standard deviations had been determined for even years the monthly figures were interpolated. Care was taken to see that the monthly increments, and the differences between those increments, increased and decreased in harmony with the direction in which the yearly increments were moving. Finally, the percentile points in each month's distributions were determined, from one year to 21

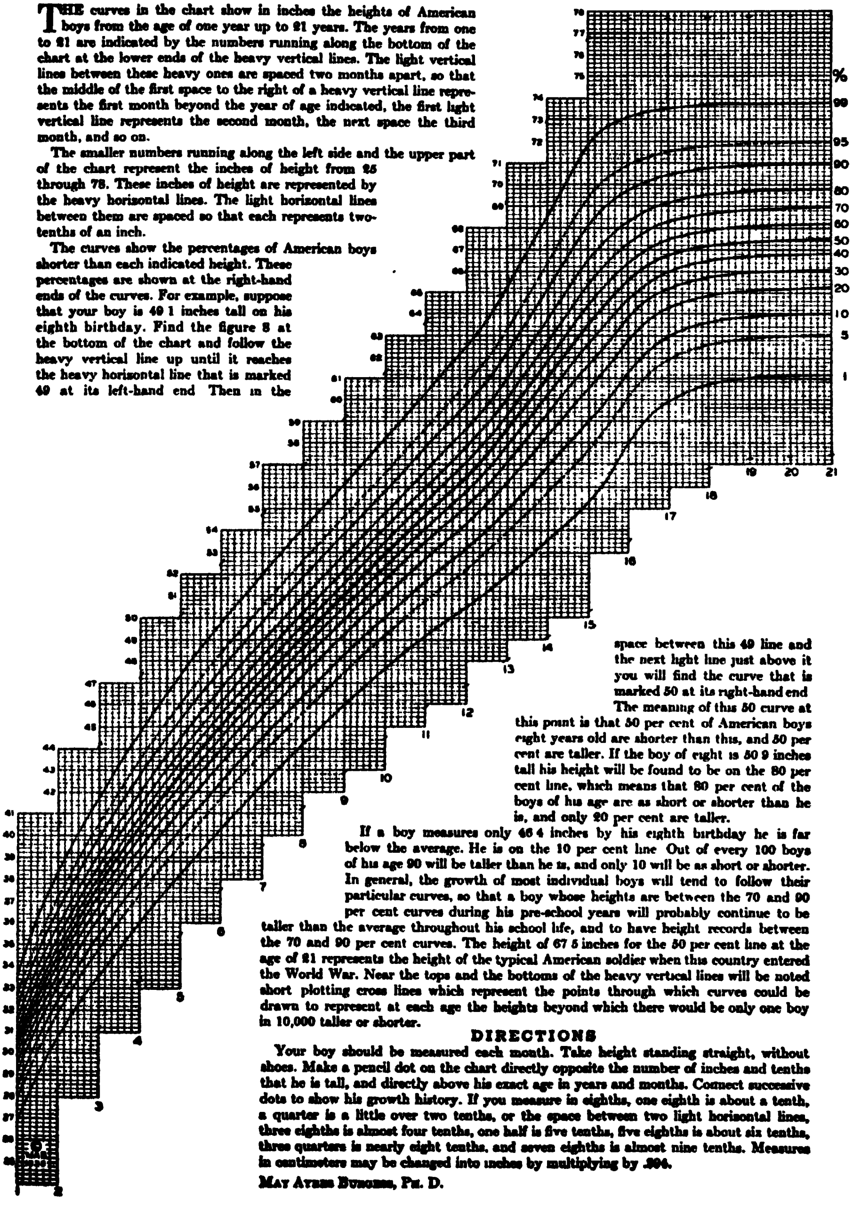
DIAGRAM 3

THE HEIGHT CHART FOR BOYS

Slightly less than one half scale

HEIGHT CHART — BOYS

NAME________________ DATE OF BIRTH____________ ADDRESS________________



THE curves in the chart show in inches the heights of American boys from the age of one year up to 21 years. The years from one to 21 are indicated by the numbers running along the bottom of the chart at the lower ends of the heavy vertical lines. The light vertical lines between these heavy ones are spaced two months apart, so that the middle of the first space to the right of a heavy vertical line represents the first month beyond the year of age indicated, the first light vertical line represents the second month, the next space the third month, and so on.

The smaller numbers running along the left side and the upper part of the chart represent the inches of height from 25 through 78. These inches of height are represented by the heavy horizontal lines. The light horizontal lines between them are spaced so that each represents two-tenths of an inch.

The curves show the percentages of American boys shorter than each indicated height. These percentages are shown at the right-hand ends of the curves. For example, suppose that your boy is 49.1 inches tall on his eighth birthday. Find the figure 8 at the bottom of the chart and follow the heavy vertical line up until it reaches the heavy horizontal line that is marked 49 at its left-hand end. Then in the space between this 49 line and the next light line just above it you will find the curve that is marked 50 at its right-hand end. The meaning of this 50 curve at this point is that 50 per cent of American boys eight years old are shorter than this, and 50 per cent are taller. If the boy of eight is 50.9 inches tall his height will be found to be on the 80 per cent line, which means that 80 per cent of the boys of his age are as short or shorter than he is, and only 20 per cent are taller.

If a boy measures only 46.4 inches by his eighth birthday he is far below the average. He is on the 10 per cent line. Out of every 100 boys of his age 90 will be taller than he is, and only 10 will be as short or shorter. In general, the growth of most individual boys will tend to follow their particular curves, so that a boy whose heights are between the 70 and 90 per cent curves during his pre-school years will probably continue to be taller than the average throughout his school life, and to have height records between the 70 and 90 per cent curves. The height of 67.5 inches for the 50 per cent line at the age of 21 represents the height of the typical American soldier when this country entered the World War. Near the tops and the bottoms of the heavy vertical lines will be noted short plotting cross lines which represent the points through which curves could be drawn to represent at each age the heights beyond which there would be only one boy in 10,000 taller or shorter.

DIRECTIONS

Your boy should be measured each month. Take height standing straight, without shoes. Make a pencil dot on the chart directly opposite the number of inches and tenths that he is tall, and directly above his exact age in years and months. Connect successive dots to show his growth history. If you measure in eighths, one eighth is about a tenth, a quarter is a little over two tenths, or the space between two light horizontal lines, three eighths is almost four tenths, one half is five tenths, five eighths is about six tenths, three quarters is nearly eight tenths, and seven eighths is almost nine tenths. Measures in centimeters may be changed into inches by multiplying by .394.

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years, for 1, 5, 10, 20, 30, 40, 60, 70, 80, 90, 95, and 99 per cent. From these figures the Height Charts for Boys and for Girls were drafted.

THE HEIGHT CHARTS IN USE

Diagram 3 shows the Height Chart for Boys as it is now being used. Each Chart is printed in green ink, on a sheet of 11×17 inch paper, so that when folded once it can be inserted in a standard manila record folder. Measures are given in inches, not in centimeters, because most people do not think readily in terms of centimeters, and it was desired to make the charts as simple as possible for practical use. While in order to secure smoothness the original computations were made in hundredths of an inch, the instructions suggest that no attempt be made to measure heights closer than to one-tenth of an inch. In fact, for most situations careful measuring to the nearest quarter inch will prove near enough for all practical purposes. It is more important to take measures carefully and frequently than to seek exact scientific accuracy on any one of them.

It should also be stressed that while the 50 per cent lines on the charts probably conform closely to the average heights of American children, and while they are very useful in certain clinical calculations, they emphatically do not represent what is "normal" for all children. Different social economic groups have different normals. A child on the 50 per cent line may be short for his age if he belongs to one group, at normal height if he belongs to another, and tall for his age if he belongs to still a different group. One of the purposes which these charts may serve is better to define for different groups of children what may reasonably be expected in the rate of growth.

Research in which the two charts are used as tools has been under way for only a short time, but the experience so far harmonizes with what is already known about growth. Year by year school height records for 922 school children have been collected and compared with the chart curves. Typically the height of a normal child follows fairly closely along his particular percentile path. He grows by fits and starts, so that his growth line is sometimes below and sometimes above, but the general trend conforms fairly closely to the percentile line. The curves bear out the findings of other investigators who report high positive correlations between adult stature and stature in childhood. Tall children start the adolescent spurt earlier than short children; and in most cases the short boy becomes a short man; the tall boy becomes a tall man.

If a child grew evenly, like clockwork, (which he does not), with no unusual glandular changes, his height expressed in percentiles would apparently remain about the same throughout his life. If, that is, at the age of one year he is so tall that only 25 out of every 100 children are taller than he and 75 out of every 100 are as short or shorter, he is growing on the 75 percentile line, and theoretically he will continue on that line, so that when he is five years old, or 10, or 14, or 21, it will still be true that out of every 100 children of his sex and age only about 25 will be taller and about 75 will be as short or shorter. What children actually do, as indicated by their school records, is shown in Table III, which contains height reports in terms of percentiles for eight boys selected as typical from large numbers of similar cases.

TABLE III

HEIGHTS ON DIFFERENT BIRTHDAYS IN TERMS OF CHART PERCENTILES FOR EIGHT TYPICAL SCHOOL BOYS

Birthday	1	2	3	4	5	6	7	8
6				75			5	
7				71	55	25	5	
8	97	85		70	54	28	10	
9	97	88		72	45	25	12	5
10	99	90	89	74	41	23	9	3
11	99	90	88	76	46	24	11	3
12	98	93	88	73	40	26	10	4
13	97	92	85	71	45	27	9	4
14	97	96	89	70	50	23	7	3
15		90	90	70	50	20		2
16		89	87		45			1
17			87					
18			86					

There are, of course, many records which do not run as evenly as these. There is a group of children, for example, who travel along a low level year after year, and then suddenly, with the onset of adolescence, shoot rapidly upward, so that they may rise 30 or 40 points in the percentile distributions. Apparently this type of growth is comparatively rare. Most short children do not experience such a spurt, but where it does occur it is so striking that it attracts attention.

Many of the apparent irregularities of growth are really due to carelessness in measurement. The rate at which a child is growing is beginning to be regarded as one of the important indicators of his general physical condition; but as yet there is little in medical literature dealing with the problem. Many school and private physicians who watch weight very carefully are content to measure height "to the nearest inch" often without regard to posture, or to measure with shoes sometimes on and sometimes off so that, according to their records, children apparently shoot up or shrink down in the most startling fashion. In many records, especially for younger children, heights and weights are transposed on the record card and much interpretation is needed to get the height picture approximately accurate.

When a height chart is kept for the individual child, and his height line entered month by month or term by term, an error in measurement stands out as dramatically as does a wrong thermometer reading on a fever chart. Where measurements are verified but the child suddenly begins to grow at an abnormal rate, either much faster or much more slowly than is usual, the graphic record gives parents, teachers, and physicians prompt warning that he needs to be kept under close observation, and possibly given special medical care. The physician does not, of course, make a diagnosis based on height alone, but a careful growth record is often a valuable diagnostic aid.

A few years ago the writer became interested in the experimental growth studies which are being carried on by Dr. Josephine Hemenway Kenyon at the Endocrine Clinic, of which Dr. Irving H. Pardee is Chief, of the Vanderbilt Clinic in New York City. The idea of constructing these Height Charts grew out of the evident need for such an instrument in measuring the effectiveness of hormone growth stimulation; and the plan was gradually enlarged to trace the growth patterns of other types of children as well. The charts were put into active use over a year ago, and one is now being kept routinely for every growth patient receiving care at the Clinic. These charts have contributed useful evidence on the rate of overgrowth in the early diagnosis of pituitary tumors and recorded graphically the changes in the patient's rate of growth under X-ray treatment. Growth abnormalities have been detected in apparently normal children; and, in the cases of children who because of slow normal growth or dwarfism are receiving growth stimulating therapy, a statistical technique is gradually being worked out for differentiating between the amount of growth which would probably have occurred had the child received no medical care and the amount which may fairly be attributed to the specific medical treatment.

The Height Charts are not yet perfected scientific instruments. Practice in the use of them will undoubtedly suggest needed changes. It is believed, however, that in their present form they are sufficiently accurate so that they will prove useful tools in the hands of parents, teachers, and physicians who wish to watch the progress of children and to identify in the early stages those who present growth problems. For investigators who are concerned with classifying special groups of children according to their characteristic growth patterns, the Charts should be especially useful because of the facility with which heights at different ages can be translated into common terms (as illustrated in Table III) so that deviations from the typical growth patterns can be readily measured. The Height Charts should also be of assistance to physicians who wish graphic records of changes in height in growth cases under observation and receiving medical treatment.

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METHODS AND PROBLEMS OF SAMPLING PRESENTED BY THE URBAN STUDY OF CONSUMER PURCHASES*

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The purpose of this paper is to present to social scientists the problems of sampling encountered in the Urban Study of Consumer Purchases and to indicate the methods designed to meet these problems. This discussion is concerned only with the Urban Study because the rural areas included in the coordinated studies presented problems of sampling quite different in many respects from those of the cities.

The authors believe that frank discussions of sampling problems are essential to an intelligent interpretation of the data resulting from any study. Furthermore, it is believed that the Consumer Purchases Study provided unusually diversified problems of sampling, so that the experience gained should be not only of interest to the student of Consumption, but also of value to social scientists who make use of sample data.

The experience gained in the field of sampling is considered of technical interest for two reasons: (1) The study included four distinct samples—a random sample, a selected random sample, a stratified sample, and a controlled sample. (2) The study was undertaken on a very large scale in all sections of the country, in thirty-two communities of varying sizes ranging from Wallingford, Connecticut, with a population of approximately 11,000 to New York City.[1]

Four different samples were obtained in the study to secure the desired data on the consumption habits of American families in the most effective way possible. Since the collection of these statistics on family expenditures and family living requires great skill and is very time consuming, it was of paramount importance to plan the size and the character of the sample very carefully. The plan devised called for the collection of data on consumer expenditures from a controlled sample, selected according to income, occupation and family type, and in addition, of data from a random sample which would indicate the relative importance of each group included in the controlled sample.

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[1] For those unfamiliar with the survey it should be pointed out that the plans for the Consumer Purchases Study, which was undertaken as a Federal Works Project, were developed jointly by the Consumption Research Staff of the National Resources Committee, the Cost of Living Division of the United States Bureau of Labor Statistics, and the Economics Division of the United States Bureau of Home Economics, with the cooperation of the Central Statistical Board. The data collected in the survey were obtained by the schedule method through personal interview with the families. The project is administered in urban communities by the Bureau of Labor Statistics and in some small cities, in villages and farm areas by the Bureau of Home Economics. A Steering Committee composed of representatives of the cooperating agencies is guiding and coordinating the project. For a short description of the study, see the articles "Plans for a Study of the Consumption of Goods and Services by American Families" this Journal, Vol. 31 (March, 1936), pp. 135–150, and "Consumer Purchases—Some Results of a National Study," by A. D. H. Kaplan, *Proceedings of the Boston Conference on Distribution*, September 29, 1936.

The general plan was to draw a random sample of about 625,000 families in the thirty-two cities studied and by progressive reduction to select from it a final controlled sample of approximately 30,000 cases. This was accomplished as follows:

(1) Only very general and easily obtainable information such as nativity, color, family composition, and housekeeping arrangements, was obtained from a random sample of the total family population of the selected communities. This information was recorded by the field agent on a *Record Card* for every one of the 625,000 families visited.

(2) From a selected random sample of approximately 250,000 of the above families, information was obtained during the same interview on income, occupation, composition of the family, type of living quarters, home tenure and rentals. These data were recorded on a *Family Schedule* obtained from all families which met certain eligibility requirements as to nativity, color, and family composition. In most cities this selected random sample was restricted to native white families containing both a husband and a wife. In New York City, Columbus, Ohio, and the South, native-born negroes were also included. In Portland, Oregon, Columbus, Ohio, and Chicago, Illinois, family schedules were also secured from single individuals.

(3) The selected random sample was supplemented by a stratified sample. This sample was needed to supply additional families of the higher income and rarer occupational groups from which the detailed data on expenditures could be obtained.

(4) The above samples were directed toward the final or controlled sample consisting of approximately 30,000 families which were asked to give the detailed information on consumption.

Thus the core of the study is this final sample of expenditure schedules controlled with respect to the factors which on *a priori* grounds are considered most significant in determining consumption habits. The main controls are nativity and color, occupation, income and family type. In addition the families must satisfy certain minor eligibility requirements as regards length of residence in the city, roomers and boarders, etc., introduced to eliminate extreme cases which would blur comparisons.

The controlled sample of expenditure schedules was planned in such a way as to avoid the concentration of cases in the modal groups, and to yield the same number of cases for each income class, for each family type in each occupational group. This distribution assures a more adequate number of cases for analysis of the expenditures of families belonging to the upper income and rarer occupational groups.

Such a controlled sample has several distinct advantages. Aside from the economy resulting from the elimination of the concentration of the cases in the modal groups, the controls assure a homogeneous sample and make it possible to "hold other things equal" while the effect of a given factor is investigated. Thus it will be possible to study changes in expenditure patterns with increase in income, holding occupation and family type constant. Furthermore, the even distribution of the observations in a controlled sample results in a smaller standard error of the regression coefficient than would have been obtained from a random sample of the same size. This is an important consideration since it is planned to employ regression lines in the analysis of the data.

The disadvantage of a controlled sample, on the other hand, lies in the fact that the groups of families cannot be combined without being properly weighted. If grouping of controls is desired, or when more cases are needed for analysis of specific expenditures, it is necessary to weight the averages or aggregates before combining them. Weighting is also necessary before the total consumption of a specified item or of groups of items can be obtained. The random sample supplies these weights for the controlled sample.

From the discussion of the character of the sample, let us turn now to the sources and methods employed in the selection of the four samples and to the problems encountered in the collection of the data from the families chosen for each sample.

THE RANDOM AND SELECTED RANDOM SAMPLE

Problems Arising in the Process of Selecting the Families. Since the selected random sample was secured at the same time as the completely random sample, both samples may be considered together. Theoretically, it would have been best to complete the random sample first. After sorting the *Family Schedules*, thus obtained into the desired breakdowns, it would have been a simple process to select the controlled sample. This procedure has, however, the following practical disadvantages:

(1) Since great uncertainty existed regarding the duration of the project it was necessary to be prepared for an early closing down of the survey. In this event, only income schedules and no expenditure schedules would have been collected.

(2) A time lag of several months between income and expenditure schedules would have been introduced. Aside from the fact that the housewife may lose interest, families move and cannot be located after several weeks have passed.

It was decided, therefore, to break up the total random sample into several subsamples, each of which was again a random sample. Selecting and obtaining a random sample of families in thirty-two cities of widely divergent sizes and with relatively untrained personnel supervising and carrying on the field investigation, made administrative considerations of paramount importance in the determination of the sampling techniques to be used.

The procedure adopted had to be such that instructions could be issued from the Washington office to city supervisors who in turn instructed field agents who knew relatively little about sampling. The technique and instructions, therefore, had to be as simple and as uniform as possible for all cities. It was likewise essential that the Washington office maintain careful control of the progress of the sample so that the procedure would be uniform throughout all cities covered by the investigation. It was imperative also, that the local office keep an exact record of the addresses assigned and visited to prevent the agents from following the line of least resistance by visiting only the most accessible families such as those residing on the first floor, those at home at the first visit, or those living near street car lines. Since a series of random samples was drawn in each city, it was necessary to keep a careful control of the addresses visited so that a given family would be drawn in only one sample.

In view of the above considerations, the selection of the sample in the *office* rather than in the *field* was deemed advisable. The choice of the source or list of names or addresses from which to draw the random sample constituted a real problem. The list used had to meet the requirements of availability, completeness, and accuracy of listing of the entire family population or of all dwelling units, up-to-dateness, and cheapness.

Sources Used. It was found that in most of the cities which were selected, city directories contained as complete a cross-section of dwelling units as could be found. All cities with the exception of Chicago and New York had recent city directories containing lists of dwelling units. Since a recent directory was not available for Chicago, the sample for this city was drawn from the 1934 C. W. A. Census of Population. In the case of New York, the City Directory had been found wanting in completeness and accuracy by research bodies which had tried to work with that source of information; the 1935 Real Property Inventory tested higher in this respect and was therefore used as the basis for the New York City sample. In all cities using directories the sample was drawn from the *street index* of dwelling units rather than from the *alphabetical name list.*

Generally speaking, investigation showed the directories to be complete and accurate in the listing of every dwelling unit, including vacancies.

In those cities in which directories were dated prior to 1934, building permits issued since 1934 were sampled to bring the sample of dwelling units up-to-date. The directory was found to be incomplete in Atlanta, Georgia, where a number of houses located in alleys and inhabited by negro families were not listed. These streets and alleys were canvassed and a sample of these addresses was added to the directory sample.

The instructions sent to the local offices for drawing the samples from the list of street addresses in the directory included a page from a directory with an illustration of the method to be used. In large cities (with populations of approximately 250,000) every twenty-fifth dwelling unit was drawn for the first sample. In middle-sized cities (with populations of approximately 50,000 persons) one in ten dwelling units was drawn for the first sample, and in small cities (with populations of about 15,000) the first sample covered one in every four dwelling units. The size of the final sample varied in the different communities depending upon the size of the city and the number of cases available for expenditure schedules. In most small cities complete coverage was made while in metropolitan and large cities the final random sample ranged from 4 to 80 per cent of the families. A directory card was prepared for each address drawn. The householder's name, so selected, as well as the floor or apartment number was written on the directory card. These directory cards were classified by census enumeration districts and the number falling into each district was forwarded to Washington for analysis. The same procedure was followed for all subsequent samples so that consistency from one sample to another as well as the proportion of families drawn in each district in each sample could be checked at headquarters.

If an address marked in the directory as a business place or a vacancy was drawn, a directory card was prepared and a visit made to the address in order to include families living in the rear of stores, and families which had moved into places vacant at the date of the directory compilation. Instructions to field agents covered cases where the address visited was occupied by a different householder from the one listed in the directory, cases where the address listed as vacant was found to be occupied, and places listed as business buildings which were found to house families.

In New York City where every twenty-fifth dwelling unit was selected from the Real Property Inventory, the problems were very similar except for the fact that the inventory did not contain the names of the families so the agents had greater difficulty locating the specific dwelling unit to be visited. This disadvantage, however, was offset by the fact that the Real Property Inventory records included information on rent or home valuation of each dwelling. This information on rent facilitated the field work because the best field agents could be assigned to the higher income families which were more likely to refuse less qualified agents. Even more important was the use of these rent data for analyzing the biases in the sample resulting from refusals and from schedules with incomplete information. The Real Property Inventory was also useful because it furnished summary sheets of the population data for each tract, thus making it possible to compare the sample with the universe for a number of population characteristics.

The random sample of Chicago addresses was drawn from the block sheets of the 1934 C. W. A. Census. One in every ten households was drawn. Unlike the Real Property Inventory of New York City, or the street index of the city directories, the Census list did not yield a sample of all *dwelling units*. The Chicago Census represented a list of *families* rather than of *dwelling units*. Vacancies were therefore not listed and it was necessary to substitute another dwelling unit if the one drawn proved to be vacant. Since it was not permissible, according to Census regulations, to record the names of the householders, and since apartment numbers were not given, detailed instructions were issued to agents on the procedure to be followed in selecting the correct dwelling unit in multiple-dwellings.

The Chicago Census was not as complete or as accurate as was desirable. Aside from errors in addresses, and duplicate listings of families, a number of tract books were missing. It was assumed that the incorrect listings were randomly distributed and did not disturb the randomness of the sample. The omission of certain tracts, however, might have introduced a real bias in the sample. Selection of the 10 per cent sample from these omitted tracts, therefore, was made in the field by the agents. A careful control of the field sampling was possible since agents kept records of the number of families in each building in the block and of the particular dwelling units drawn for the sample. Field production when the sampling was done in the field proved to take about a third longer than when the sample was selected in advance of the field assignment. However, the office time taken to draw the sample from the census was eliminated. Despite the above limitations of the census it is felt that with the precautions taken, the Chicago sample is a satisfactory random sample of the city.

Problems Arising in the Process of Collection. Thus far we have discussed the selection of the families to be interviewed. While this is recognized as a very important part of sampling procedure, it should be pointed out that random selection is no guarantee that a random distribution of cases will be collected finally. Sampling theory is usually concerned with results obtained from a random selection of black and white balls from an urn on the assumption that the experimenter has no difficulty pulling the balls out of the urn. Unfortunately for social scientists, human beings do not behave like balls in an urn. Some very real problems of sampling arise in the process of collecting data from the families selected at random.

Paramount among the problems encountered in the field are refusals, the inability of families to give the desired information, and unsuccessful attempts to contact families.

Both preventive and corrective measures were adopted to meet the problems of refusals and of failures to contact families. Incomplete schedules and refusals are largely due to the approach used by the field agent, so the best preventive measures are directed at a careful training of agents and control of assignments. Calls at night to interview someone other than the person refusing, eliminating those agents who turn in too many refusals, shifting unsuccessful agents from the more difficult districts to the sections where families are more cooperative, reduced refusals. The agents in the present study were instructed to make at least two calls upon families before turning in the cards with partial or no information. Assignment supervisors were instructed to assign cases for a third visit to different and more skilled agents. Another control of the work of the agent was exercised through *check interviewing* which made it possible to discover agents who reported vacancies when families refused information. It was claimed by some supervisors that emphasis on speeding up production would increase the number of incomplete and unacceptable schedules. This was not found to be the case, however. In fact, the most productive agents also had the fewest refusals, and the most accurate schedules. A third important preventive measure consisted in securing favorable presentation of the investigation in the press.

Corrective methods in assuring the collection of the random sample as selected, consisted in measuring the biases introduced by refusals, incomplete schedules, and cases where families could not be contacted. The first analysis of any possible biases was made by finding the proportion of refusals and uncontacted cases in each district. Early reports indicated that a significant number of families in the wealthier neighborhoods were not at home or refused to give the information requested. During the hottest weeks of the summer months as many as 50 per cent of the families in the better districts of the large cities had left the city and moved to vacation places. It was possible to revisit these families upon their return to the city in the fall after the early analysis had revealed the need for revisits.

The analyses of occupations of uncooperative family heads provided another measure of the biases introduced by refusals. The occupation listed in city directories, supplemented in small cities by information supplied by staff members who were acquainted with many families, made possible the analysis of the proportion of refusals and uncontacted cases in each occupational group. A preliminary analysis, prepared before the final work on "reclaiming" had been completed, indicated that refusals and uncontacted families were less than half as frequent, proportionately, among wage earners as among other occupational groups. Clerical and salaried professional persons showed the next smallest percentage of refusals, while families of business and professional persons working on their own account had the highest proportions of refusals. This is partly due to the fact that business and family accounts often are not kept separately and, therefore, it is often too difficult for persons working on their own account to report the information on family income and expenditures in the desired form.

The analysis of the distribution of refusals and uncontacted cases by rent groups was possible in New York City where the Real Property Inventory provided rent data for every dwelling unit. A preliminary tabulation of these cases revealed a concentration of unsuccessful cases in the upper rent groups. Unacceptable or incomplete schedules were approximately twice as frequent in the rent groups over $50, (in proportion to the total number of families in this group), as in rent groups under $50 per month. A further attempt to measure the bias introduced by schedules which were unacceptable will be made for partially completed schedules in all communities.

Having analyzed the type of bias in the sample, the need for reclaiming the cases in the upper income and rarer occupational groups became apparent. Experience taught us that the best agents could successfully reclaim many of the families reported as uncooperative by the original agent. A "recapture" program was instituted, therefore, in all cities and it is expected that the percentage of refusals and incomplete schedules will be reduced considerably.

Supervisors were instructed to assign for recapture a sufficient number of cases in the less frequent occupational groups to reduce the final proportion of unsuccessful cases to that found in the wage earner families. Thus in the end the refusals and incomplete group should be randomly distributed with respect to occupation—one of the controls for the controlled sample.

Since time and funds were limited, the relatively extensive and time consuming recapture program was supplemented in cities with limited coverage by a provision for the substitution of a neighboring family for the family refusing information. The regular agents were not permitted to make the substitutions since the supervisors felt that this would have caused them to place less effort than was desired on obtaining the assigned cases. The instructions for substitutions were so drafted that only "similar income" families were contacted for substitutions.

If the recapture and substitution program did not equalize the proportion of refusals in all occupational groups, it is possible to estimate the influence the omitted cases would have exerted on the occupational or income distribution had they been included. These estimates will be based on the data on the relation between rent and income, and occupational distribution by districts.

THE STRATIFIED SAMPLE

Insofar as possible, the families giving the detailed expenditure schedule information were to be drawn from the random sample. The random sample was planned not only to give adequate weights for the controlled sample, but to yield approximately 80 per cent of the cases needed for the expenditure schedules. Generally speaking the wage earners and clerical groups were found in sufficient numbers in the random sample to yield the required number of expenditure schedules. The salaried and independent professional and business groups, however, did not occur in the random sample in sufficient numbers to fill the required cells. It was necessary, therefore, to draw these needed cases from outside the random sample or from the "stratified sample." The procedure adopted was two-fold. First, in certain of the large cities such as Denver, and Atlanta, it was found that the rarer occupational groups were concentrated in a few districts of the city. Thus, by taking a larger or more intensive random sample of these districts than in the other sections of the city, the desired number of cases eligible for expenditure schedules were obtained. In other large cities, the needed upper income groups were drawn from suburbs which were essentially parts of the cities studied, but which were not included in the random sample because of the difficulties which would have been encountered when testing the sample against Census and other data for the city. In Columbus, Ohio, for example, the stratified sample was drawn from the suburb of Bexley, which is surrounded by the city proper. City supervisors were cautioned not to rely entirely upon the cases yielded by these districts since there was danger of producing a bias in the expenditure data of the upper income groups by including too many families living in the same area, paying similar rents, and probably having other similar expenditure patterns.

List sampling constituted the second procedure used for obtaining the additional cases in the stratified sample. The list of families in the rarer occupational groups was compiled from numerous sources such as lists of professional people, business executives, store owners, etc. The specific occupations represented in the list were chosen so as to be as similar as possible to groups occurring in the random sample. Supervisors were cautioned not to overload the list with telephone subscribers. Considerable work was involved in checking over the addresses drawn by list sampling with those already found in the random sample in order to avoid contacting the same family more than once. List sampling did not prove to be very successful. This may be attributed to two factors. In the first place, the random sample was so large that as many as 60 per cent of the families in the city had been contacted before the list sampling began. Thus, the problem of weeding out the uncontacted families involved considerable clerical work. A second reason for the lack of success of the list sampling may be attributed to the difficulty of finding families which met the requirements of three controls. It proved to be almost impossible to find by list sampling methods cases of the correct income, occupation, and family types needed for expenditure schedules. In Omaha, for example, where a 32 per cent random sample had been made, less than 5 per cent of the names assigned from lists yielded completed and needed expenditure schedules.

THE CONTROLLED SAMPLE

It was pointed out above that the core of the study is a controlled sample of families giving detailed information on expenditures. This sample was selected according to a pre-arranged plan, which specified the number of cases desired for each final breakdown or "cell." Since the number of cases in these final breakdowns is small, it was of paramount importance to obtain randomness in the selection of families for these "cells." Great care was therefore taken to guard against the introduction of a bias. Even the first small random sample yielded all the desired cases for the most frequent population groups. If the cells drawn from the modal population group had been filled from the first sample, they would have been much more homogeneous with respect to the period covered by the data than cells which represent the less frequent population groups, and any greater variability within the latter cells might have been attributed to income or occupation while it might actually have been due to price changes occurring while the study was in progress. This possible bias was minimized by the provision that not more than 50 per cent of the cases in cells representing the most frequent population groups were to be chosen from one sample and that all expenditure schedules which were discarded later because income and expenditures did not balance should be replaced by cases drawn from recent samples. It is recognized, however, that these provisions did not entirely eliminate the bias introduced by the time element.

Regarding the problems of collection, it is not so much the *unwillingness* as it is the *inability* of the family to give the information, which makes the maintenance of a random selection of families for the controlled sample so difficult. There are certain technical difficulties inherent in the underlying principles of the study itself which affect the selection of the cases in the controlled sample. The more important of these is the requirement that receipts and disbursements of the family over the year must balance within 5 per cent. Those schedules which do not balance are unacceptable. It has been shown in previous studies of family expenditures that the more intelligent and the more thrifty persons are most likely to keep records, and therefore are able to account for income and expenditures most accurately. Thus a bias may be introduced in the controlled sample of families giving acceptable schedules. In order to guard against this bias, the best field workers are used for expenditure schedule work, in order to secure from the family complete and acceptable expenditure information. Revisits, telephone calls to the family to clear up missing items, and interviewing the husband are necessary to make schedules acceptable but these procedures are preferable to discarding schedules.

At the present stage of the investigation, it was necessary to emphasize the administrative problems encountered in collecting the samples. We feel that the problems are not unique to this Study, but are encountered to a greater or less extent in most studies of social phenomena. The final appraisal of the techniques used will be made at a later date when the samples have been tested against the universes from which they are drawn.

CONSISTENCY OF RECORDING STATISTICAL DATA FROM PRISON FILES*

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All who work with sociological data are aware of the difficulties met in classifying sociological phenomena according to a set scheme which is essential for statistical analysis. Often when we attempt to measure the margin of error in categorization, we are surprised to find how serious it is with regard to certain social phenomena such as family relationships or social type. Inquiry into the accuracy and biases of recording and classification is a neglected but very important field for research.

In the criminological field this problem was fully appreciated by George B. Vold,[1] who attempted to ascertain the consistency of his classifications; first, by a reclassification of 198 cases eight weeks after the first entries had been made, and, secondly, by having another investigator make an independent classification of 63 of these same cases. In some items the percentage of agreement between the first and second classification was as high as 97 ("use of drugs") or 92 ("outcome of parole"). In other items, as "social type of inmate," the percentage was as low as 50.

The classification made by Vold and that made by a graduate student were, in general, somewhat less consistent than those obtained by the two recordings of Vold.

In another study of a similar nature by Tibbitts,[2] a reclassification of 907 parolees used in Burgess's classical study[3] showed appreciable inconsistencies, the percentage of error ranging from 1 for "nature of sentence" to 39 for "work record." In 39 per cent of the cases, the classification of an individual with respect to work record differed from the original classification of that individual made from the same record and according to the same scheme of classification.

The present study of consistency in recording was undertaken in connection with the nation-wide study initiated by the Attorney General of the United States and financed by WPA funds. The samples analyzed in this study are based on data taken from the records of persons released provisionally from Federal institutions during the period 1930 to January 1, 1936, and whose provisional release terminated, successfully or unsuccessfully, within the same period.

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* A paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association (at a joint session with the American Sociological Society), Chicago, December 28, 1936.

[1] Vold, George B., *Prediction Methods and Parole*, Sociological Press, Minneapolis, Minn., 1931.

[2] Tibbitts, Clark, "Reliability of Factors Used in Predicting Success or Failure in Parole," *Journal of Criminal Law and Criminology*, vol. XXII, no. 6 (March 1932), p. 844 et seq.

[3] Bruce, Burgess, Harno, and Landesco, "Parole and the Indeterminate Sentence—the Workings of the Indeterminate Sentence Law and the Parole System in Illinois," *Journal of Criminal Law and Criminology*, vol. XIX (May 1928), pp. 239–286.

In view of the fact that this study is being carried on largely by relief workers, most of whom have no technical training in sociology, statistics, or allied branches of learning, it was felt especially imperative that the consistency with which information was being transcribed from the files onto our statistical schedules be determined with a reasonable degree of precision. Aside from this primary consideration, there were a number of secondary objectives justifying a careful study of the degree of this consistency.

In comparison with the studies of Vold and Tibbitts, there are certain distinctive features of this study which should be noted. The most important is that the consistency of many more items was determined than in the former studies. A second distinction is that larger samples were used than in the former studies. Thirdly, consistency was measured in *three* separate samples, taken at different periods during the recording of the 25,000 Federal cases, thereby giving a measure of the improvement in consistency that can be brought about by training a group such as the one which carried on this study. Fourthly, recordings and re-recordings were done by a group of relief workers under the personal supervision of young men selected on the basis of general ability, but without any special sociological or statistical training, a lack which was compensated for by providing very detailed instructions to each worker. Finally, each recording of the samples was made by a different group of people, the members of which, working independently, recorded in each case the entire schedule.

In setting up groups in Washington to record the schedules for Federal cases, one person with two assistants was assigned to the files to remove the jackets (prison records) for each institution and to allocate these jackets daily to the eight supervisors. Each supervisor had assigned to him from five to seven relief workers, who were seated around a long table at the head of which sat the supervisor.[4]

Each group had assigned to it one, two or three Federal institutions, and each individual worked only with jackets from one Federal institution, even if more than one institution was assigned to his table. This arrangement was made so as to make it possible for each recorder to become thoroughly familiar with one set of jackets and thus lessen the likelihood of errors.

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[4] These supervisors after their training in Washington were eventually sent into the field as regional field supervisors.

Each morning the supervisor distributed three or four jackets to each of the workers assigned to him and before noon these jackets and the completed schedules for them were returned to the supervisor for verification. The same procedure was followed in the afternoon. Each recorder was given a number which he placed on every schedule that he completed, so that errors could be called to his attention and the number of schedules and of errors per schedule could be recorded on a daily individual output sheet. The schedules were then verified by the supervisor and the jackets returned to the person in charge of the files. The work of the supervisors was checked on the basis of sample schedules selected at random from each group after they had been recorded and verified.

When the first 2,000 Federal schedules had been completed, the assignment of institutions to the various tables was completely changed and the first 500 recordings were recorded a second time. The change in assignment of institutions to tables made it certain that no person recorded or verified a schedule for the same individual inmate a second time. The preliminary analysis of this first re-recording was used to eliminate certain items in which the inconsistency was altogether too great and to clarify portions of the instructions where the consistency analysis showed that greater sharpening and precision of definition was necessary.

These first 500 cases constitute the first sample by which the degree of consistency was determined. When 10,000 Federal schedules had been recorded, once more the assignment of institutions to different tables was changed and the last 501 of these cases were re-recorded. Again, no individual recorded or verified the same schedule he had done previously. It may be mentioned that at no time were either the supervisors or the recorders informed ahead of time when a new re-recording was to be initiated.

When 23,000 Federal schedules had been recorded, the assignment of institutions to different tables was changed a third time and a third sample of 500 cases was re-recorded. Subsequently, when all the Federal cases were completed, this last sample of 500 cases was recorded a third time, but this last recording will not be dealt with here.

The classifications of cases by the first and second recording were analyzed for each of 124 items, such as race, marital status, number of children, and criminal record. In the analysis of the first sample, in addition to percentage of error, the coefficient of contingency was also determined, as well as the chi-square value when the distribution derived from the first recording was compared with the distribution obtained from the second recording. The results confirmed the earlier

deduction based on theoretical considerations; that contingency coefficients are of little significance in an analysis of this nature.

TABLE I
LENGTH OF SENTENCE

Analysis of the Third Sample

First recording	Second recording								
	X0	X2	X3	X4	X5	X6	X7	X	Total
X0 20 years and over	1								1
X2 6 months–1 year, 1 day		90	3						93
X3 1 year, 2 days–1½ years		1	77						78
X4 19 months–2½ years				161					161
X5 31 months–4½ years					154				154
X6 55 months–5½ years						12			12
X7 67 months–9 years							1		1
XX Unknown									
Total (3rd sample)	1	91	80	161	154	12	1		500
Average percentage		98	97	100	100	100			99.2

Aggregate of All Three Samples

First recording	Second recording								
	X0	X2	X3	X4	X5	X6	X7	XX	Total
X0 20 years and over	2								2
X2 6 months–1 year, 1 day		436	8					1	445
X3 1 year, 2 days–1½ years		7	385		2				394
X4 19 months–2½ years			2	351	1				354
X5 31 months–4½ years				1	249	1			251
X6 55 months–5½ years					1	50			51
X7 67 months–9 years							4		4
XX Unknown									
Total	2	443	395	352	253	51	4	1	1501
Average percentage		98	98	99	99	98			98.4

Summary Values

	I	Total in diagonal	Percentage of agreement	% S. E.	Fiducial limits when $P = .01$	
					Upper	Lower
First sample	9	485	97.0	.77	98.96	95.04
Second sample	25	496	99.0	.45	100.00	97.87
Third sample	31	496	99.2	.40	100.00	98.17
Aggregate (all samples)	48	1477	98.4	.32	99.22	97.58

The chi-square analysis showed, as had been expected, that, despite appreciable percentage deviation, the general distributions obtained from the two recordings were homogeneous; that the statistics derived from these two recordings were not significantly different. In the analysis of subsequent samples, the computation of contingency coefficients and the chi-squares for the distributions were discontinued.

Table I, dealing with length of sentence, shows the comparative analysis of the third sample. The vertical frequencies give the distribution of cases according to the second recording, while the horizontal frequencies show the distribution resulting from the first recording. The frequencies in the diagonal represent cases in which both the first and the second recorders were in perfect agreement. As this item is one in which the percentage of agreement was very high, the comparative analyses of samples one and two are essentially identical with that given for sample three.

It will be noted that the first recorders found 93 cases having a sentence of six months to one year and a day. The second recorders reported 91 such cases. In 90 cases, the classifications of the first and the second recorders were identical. Of persons with a sentence of one year and two days to one and one half years, 78 cases were reported by the first recorders, 80 by the second, and in 77 of these cases both groups of recorders were in agreement.

The percentages given in line with the caption, "average percentage," are obtained by adding the frequencies in corresponding columns and rows and dividing twice the frequency found in the diagonal by this sum. It gives an approximate percentage of agreement between two groups of recorders with respect to cases falling in a particular column and row.

The aggregate table combining all the three samples has the same significance; out of 1,501 cases, the first recorders found 445 with a sentence of six months to one year and a day, and the second recorders reported 443 such cases. In 436 of these cases both groups of recorders were in agreement.

The statistics obtained from the analyses of these samples are shown in the summary values for Table I. I, the amount of information obtained from each sample, is equivalent to the expression, $n/(pq)$, where n is the number of cases considered, p is the probability of a case being within the diagonal, and $q=1-p$. This function is the reciprocal of the variance and its significance is explained by R. A. Fisher in *The Design of Experiments*. S. E. is the standard error in terms of percentages, and the fiducial limits give the probable range of variation of percentages of cases in the diagonal with a probability of .01.

It should be stated in this connection that the various samples were combined only after testing their homogeneity. In a number of in-

TABLE II
COMMUNITY: PAROLE RELEASE

First recording	Second recording												
	1	2	3	4	5	6	7	8	9	0	V	X	Total
First Sample													
1 500 or more	79	3		1	1	1	1	2			1		89
2 250–499	1	38	1			1							41
3 100–249	1		30							1			32
4 50–99	1			21									22
5 25–49	3		2	1	24					1			31
6 10–24	3			1		30		1		1		1	37
7 5–9	2						15	1	1	1			20
8 2.5–4	2			1				19		1			23
9 1–2.4	1	1	1			1	1	2	58	2	1	3	71
0 Counties	4		2	1	1	1	1		4	93		1	108
V Inapplicable	1										19		20
X Unknown										1	2	3	6
Total	98	42	36	26	26	34	18	25	63	101	23	8	500
Average percentage	84	92	88	87	84	84	79	79	87	89	88	43	85.8
P of chi-square	.46	.91	.62	.55	.49	.71	.74	.76	.46	.59	.64	.59	
Second Sample													
1 500 or more	55		1	2					1				59
2 250–499		77					1			3		1	82
3 100–249	1		25				1			2	1		30
4 50–99				41									41
5 25–49					14		1			1			16
6 10–24						33			1	4		1	39
7 5–9		1				1	24						26
8 2.5–4				1				9	1	1			12
9 1–2.4			1	1					30	4			36
0 Counties		1					2		3	115	3	1	125
V Inapplicable											28		28
X Unknown	1	1			1						1	3	7
Total	57	80	27	45	15	34	29	9	36	130	33	6	501
Average percentage	95	95	88	95	90	90	87	86	83	90	92	46	90.6
Third Sample													
1 500 or more	49						1				1		51
2 250–499		61	2					1		1			65
3 100–249		1	31						1			1	34
4 50–99				27						1			28
5 25–49				1	30								31
6 10–24						23				3			26
7 5–9							32		1	2			35
8 2.5–4				1				19		5			25
9 1–2.4						1			25	2			28
0 Counties		1	1	2	3	4	4	2	7	135			159
V Inapplicable											17		17
X Unknown							1						1
Total	49	63	34	31	33	28	38	22	34	149	18	1	500
Average percentage	98	95	91	91	94	85	88	81	81	88	97		89.8

TABLE II (*Continued*)

First recording	Second recording												
	1	2	3	4	5	6	7	8	9	0	V	X	Total
Aggregate													
1 500 or more	183	3	1	3	1	1	2	2	1		2		199
2 250–499	1	176	3			1	1	1		4		1	188
3 100–249	2	1	86				1		1	3	1	1	91
4 50–99	1			89						1			96
5 25–49	3		2	2	68		1			2			78
6 10–24	3			1		86		1	1	8		2	102
7 5–9	2	1				1	71	1	2	3			81
8 2.5–4	2			3				47	1	7			60
9 1–2.4	1	1	2	1		2	1	2	113	8	1	3	135
0 Counties	4	2	3	3	4	5	7	2	14	343	3	2	392
V Inapplicable	1										64		65
X Unknown	1	1			1		1			1	3	6	14
Total	204	185	97	102	74	96	85	56	133	380	74	15	1501
Average percentage	91	94	80	92	89	87	85	81	84	89	92	41	88.7

Summary Values

	I	Total in diagonal	Percentage of agreement	% S. E.	Fiducial limits when $P = .01$	
					Upper	Lower
First sample	2	429	85.8	1.56	89.82	81.78
Second sample	3	454	90.6	1.31	93.97	87.27
Third sample	3	449	89.8	1.35	93.28	86.32
Aggregate (all samples)	8	1332	88.7	.82	90.85	86.63

stances the criterion of homogeneity used was a P of .05, while in others a less rigid criterion, $P = .01$, had to be used. In those samples where the homogeneity fell below .01, no combinations were made.

Table II represents items with a medium degree of agreement between the first and the second recording. Thus, in the first sample the percentage of agreement is 85.8, which means that in 85.8 per cent of the cases both groups of recorders made identical classifications, these being represented by the frequencies found in the diagonal. In the second sample this complete agreement holds true in 90.6 per cent of the cases, and in the third sample in 89.8 per cent. The summary analysis for these three samples is also shown.

The percentage of agreement between the two recordings for the entire 1,501 cases is 88.7. It may be noted here that the greatest error in this table is in connection with the "unknown" column. This would suggest that probably a good share of the error was made by the coders and not merely by the recorders. The item (Community: Parole Release) refers to the size of the community (in terms of population according to the 1930 census) to which the subject was sent at the time he was granted his provisional release. The recorders were required to give the name of the town and of the state, and the coders, with the aid of a gazetteer, were to find the population of these cities and towns, and to code them accordingly. Except in the category "unknown," the agreement in most of the other columns and rows is appreciably higher than the aggregate percentage of agreement, 88.7, would indicate.

The third table (Table III) shows the average monthly earnings in the last job, one of the least consistent items. In the first sample the percentage of agreement is only 49.4, in the second sample, 52.3, and in the third sample, 62.4. All of these percentages are decidedly lower than the agreements obtained for most of the other items. In this item the chi-square analysis of the three samples indicates a lack of homogeneity between the three samples. Only the first and second samples are homogeneous according to this criterion. The summary table, therefore, shows only this combination. In this table the fiducial limits were computed with $P=.05$ as a basis.

An analysis similar to that represented by the three tables described above was made for each of the 124 items on the schedule. Table IV summarizes the results of this analysis for 63 of the 124 items.[5]

This summary table shows in the first column the items studied arranged in five major groups, namely, parental background, personal, criminal, institutional, and parole history. Column 2 shows the percentages of agreement between the entries of the first and the second group of recorders for the third sample of 500 cases. In column 3 are found the corresponding percentages obtained from the second sample, and in column 4 those derived from the first sample. Column 5 shows the agreement either for two or for three samples in combination. All samples were tested for homogeneity and were combined only where the criterion of homogeneity did not fall below .01. In column 6 is given the amount of information, the significance of which has already been explained. The amount of information applies to the aggregate of the samples shown in column 5.

In many instances the homogeneity would be demonstrated, even though a P of .05 were to be used as the criterion. In cases where the test of homogeneity indicated that all the three samples were not homogeneous, two of the three samples were combined using the same

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[5] Dr. Sanders' manuscript was submitted for publication with the full list of 124 items, but in the interests of economy the Editor reduced the table to a single page by deleting half of the items. Among the items that were deleted were those whose precise meaning was not very apparent without further explanation. The distribution of percentages of agreement for the items eliminated was quite similar to that for the items retained. The full list may be secured from the author.—*Ed.*

TABLE III

AVERAGE MONTHLY EARNINGS LAST JOB

First recording	Second recording												
	1	2	3	4	5	6	7	8	9	0	V	X	Total
First sample													
1 Under 20	3	1					1				1	4	10
2 20– 49	3	10	2	2	1	1			1		1	4	25
3 50– 79	1	6	41	12	1		1		1		1	6	70
4 80–109		1	4	32	8	4	2	1	4			6	62
5 110–139			1	3	14	7	1	1	2			7	36
6 140–169			1		1	8	1	1				9	21
7 170–199		2	3	1		2	7		2			1	18
8 200 and over		1	1	2		2	3	14				3	26
9 Own account or commission		1	3	3	1	1	1	3	20			12	45
0 None		1	2		1							1	5
V Inapplicable							2			1	3	2	8
X Unknown	5	7	16	9	3	2	3	2	28	2	2	95	174
Total	12	30	74	64	30	27	22	22	58	3	8	150	500
Average percentage	27	36	57	51	42	33	35	58	39		37	59	49.4
P of chi-square	.67	.49	.72	.85	.45	.37	.52	.46	.18	.50	1 00	.10	
Second sample													
1 Under 20	1	1							1		1		4
2 20– 49		11	5	2	1				3		4	5	31
3 50– 79		4	16	7					1		7	11	46
4 80–109			3	22		2			1		3	5	36
5 110–139			1	3	11				2		1		18
6 140–169				2		15			3		1	2	23
7 170–199							2					1	3
8 200 and over				1	1		1	10	3		1	1	18
9 Own account or commission				1	1	1			23		14	11	51
0 None													
V Inapplicable	1	2	6	1	1	2		2	9		95	29	148
X Unknown	1	3	7	4			2	1	14		35	56	123
Total	3	21	38	43	15	20	5	13	60		162	121	501
Average percentage		42	38	56	67	70		64	41		61	46	52.3
Third sample													
1 Under 20													
2 20– 49											1	6	7
3 50– 79								1				2	3
4 80–109				2			1		1		2	7	13
5 110–139				1	5	1					1	4	12
6 140–169					1	3	1				1	1	7
7 170–199							6				1	2	9
8 200 and over								2			1	1	4
9 Own account or commission								1	36		17	24	78
0 None													
V Inapplicable			1					1	13		38	20	73
X Unknown			2	3	1	4		1	23		40	220	294
Total			3	6	7	8	8	6	73		102	287	500
Average percentage				21	53	40	71	40	48		43	76	62.4

TABLE III (*Continued*)

First recording	Second recording												
	1	2	3	4	5	6	7	8	9	0	V	X	Total
First two samples													
1 Under 20	4	2					1		1		2	4	14
2 20– 49	3	21	7	4	2	1			4		5	9	56
3 50– 79	1	10	57	19	1		1		2		8	17	116
4 80–109		1	7	54	8	6	2	1	5		3	11	98
5 110–139			2	6	25	7	1	1	4		1	7	54
6 140–169			1	2	1	23	1	1	3		1	11	44
7 170–199		2	3	1		2	9		2			2	21
8 200 and over		1	1	3	1	2	4	24	3		1	4	44
9 Own account or commission		1	3	4	2	2	1	3	43		14	23	96
0 None		1	2		1							1	5
V Inapplicable	1	2	6	1	1	2	2	2	9	1	98	31	156
X Unknown	6	10	23	13	3	2	5	3	42	2	37	151	297
Total	15	51	112	107	45	47	27	35	118	3	170	271	1001
Average percentage	28	39	50	53	50	50	37	61	40		60	53	50.8

Summary Values

	I	Total in diagonal	Percentage of agreement	% S.E.	Fiducial limits when P = .05	
					Upper	Lower
First sample	1	247	49.4	2.24	53.77	45.03
Second sample	1	262	52.3	2.23	56.67	47.93
Third sample	1	312	62.4	2.17	66.65	58.15
First and second	2	509	50.8	1.58	53.95	47.75

criterion. The combinations are indicated by symbols explained at the end of the table. For all items, the number of cases included was 500 for the third sample, 501 for the second, and 500 for the first. However, in a few items, the questions were not applicable to all of the 500 cases. These items, in which the number of cases is less than 500, are indicated by an asterisk.

Table IV is to be interpreted as follows: The first item, race of father, shows in the third sample perfect agreement between the two groups of recorders in 98.8 per cent of the cases. That is, there were in the entire 500 cases only 6 in which the race designation given by the first group of recorders was different from that given by the second. The comparable percentage in the second sample was 97.8 with a standard error of .66 and in the third sample 97.4 with a standard error of .71. All the three samples were homogeneous so that for the 1,501 cases the percentage of agreement with respect to the race of subject's father was 98 with a standard error of .36. That is, there

TABLE IV—CONSISTENCY IN RECORDING DATA FROM PRISON FILES

Items recorded	Percentage of agreement± 1 standard error				Amount of information
	Samples			Aggregate (a)	
	Third	Second	First		
1	2	3	4	5	6
PARENTAL BACKGROUND					
Race of father	98.8± .49	97.8± .66	97.4± .71	98.0± .36	38
Race of mother	98.6± .53	97.8± .66	97.8± .66	98.1± .36	40
Citizenship of father	95.0± .97	88.6±1.42	79.8±1.80	—	—
Religion of father	93.4±1.11	92.6±1.17	77.4±1.87	93.0± .81c	8
Religion of mother	93.8±1.08	91.8±1.23	75.2±1.93	92.8± .82c	8
Occupation of father	75.4±1.93	74.0±1.96	62.4±2.17	74.7±1.37c	3
Economic status parents	98.6± .53	87.4±1.48	41.0±2.20	—	—
Delinquency and criminality in family	90.8±1.29	86.6±1.52	85.8±1.56	87.7± .85	7
Mental and nervous diseases in family	98.8± .49	97.6± .69	96.2± .86	97.5± .40	31
Size of parental family; own sisters	86.6±1.52	69.5±2.06	72.2±2.01	70.8±1.44d	2
Size of parental family; own brothers	88.4±1.43	74.4±1.95	63.8±2.15	69.1±1.46d	2
Size of parental family; other sisters and brothers	92.2±1.20	82.6±1.70	86.8±1.52	89.5± .97b	5
PERSONAL HISTORY					
Birth date	96.6± .81	92.6±1.17	91.0±1.28	94.6± .71c	10
Birthplace	98.4± .56	97.4± .71	98.4± .56	98.1± .35	40
Birth rank	89.8±1.35	78.4±1.84	62.2±2.17	—	—
Nativity	98.4± .56	98.2± .60	97.2± .74	97.9± .37	37
Habits	70.6±2.04	51.9±2.23	60.0±2.19	55.9±1.57d	2
Age at leaving school	85.6±1.57	88.6±1.42	83.8±1.65	86.0± .90	6
Education	63.0±2.16	80.0±1.79	64.6±2.14	63.8±1.52b	2
Psychiatric classification	99.2± .40	80.8±1.76	68.4±2.08	—	—
Marital status	91.2±1.27	90.4±1.32	88.6±1.42	90.9± .77	8
Age at first marriage	87.8±1.46	87.6±1.47	87.0±1.51	87.5± .85	7
Number of children: own	95.6± .92	94.8± .99	92.0±1.22	94.1± .61	14
Number of children: other	97.8± .66	97.6± .69	94.6±1.01	96.7± .46	23
Number of dependents. minors	84.0±1.64	82 4±1.70	81.8±1.73	82.7± .98	5
Number of dependents adults	82.6±1.69	76.2±1.90	72.4±2.00	79.4±1.28c	3
*Occupation first pursued (male)	51.9±2.29	54 3±2.27	41.1±2.27	53.1±1.61c	2
*Occupation first pursued (female)	54.5±10.62	58.8±11.94	74.2±7.86	64.3±5.73	—
*Occupation, usual (male)	54.6±2 28	55.2±2.26	45.6±2.30	51.8±1.32	3
*Occupation, usual (female)	68 2±9.93	47.1±12.11	58.1±8.87	58.6±5.89	—
Number of months unemployed	48 2±2.23	41.7±2.21	46.2±2.23	45.4±1 29	3
Average earnings at last job	62.4±2.17	52.3±2.23	49.4±2.24	50.8±1.58d	2
CRIMINAL HISTORY					
Nature of first offense	74.6±1.95	75.0±1.94	73.8±1.97	74.5±1.13	4
Age at first arrest	80 2±1.78	79.2±1.81	68.6±2.08	79.7±1.27c	3
Disposition, first arrest	72 2±2.00	67.1±2.10	58.2±2.21	69.6±1.45c	2
Number of arrests	74.0±1.96	61.7±2.17	68.8±2.07	71.4±1.43b	2
Number of arrests without conviction	80.6±1.77	75.0±1.94	70 0±2.05	77.8±1.31c	3
Number of sentences to penal and correctional institutions	85 8±1.56	75.0±1.94	77.0±1.88	76.0±1.33d	3
Number of escapes	96.6± .81	95.6± .92	85.6±1.57	96.1± .19c	13
Present offense	91.6±1.24	96.0± .88	87.8±1.47	89.7± .96b	5
Number of aliases	84.6±1.61	80.6±1.77	—	82.6±1.20c	3
Plea entered	94.6±1.01	94.4±1.03	92.4±1.19	93.8± .62	13
INSTITUTIONAL HISTORY					
Age when admitted to institution for present offense	95.8± .90	93.8±1.08	87.2±1.49	94.8± .70c	10
Length of sentence	99.2± .40	99.0± .45	97.0± .77	98.4± .32	48
Fine and / or costs	98.2± .59	97 4± .71	82.0±1.72	97.8± .46c	23
Time served, present offense	97.6± .68	99.6± .28	94.8±1.00	98.6± .37c	36
Offenses, institutional	88.8±1.41	84.6±1.61	85.4±1.58	86.3± .89	6
Occupation in institution	83.4±1.66	77.6±1.86	68.6±2.08	80.5±1.25c	3
Work habits	84.6±1.61	78.0±1.85	70.0±2.05	81.3±1.23c	3
Judge and prosecuting attorney	80.8±1.76	78.4±1.84	61.4±2.18	79.6±1.27c	3
PAROLE HISTORY					
Mode of release	99.0± .44	99.4± .34	96.2± .86	99.2± .28c	63
Age at time of release	97.8± .66	93.0±1.14	89.2±1.39	91.1± .90d	6
Residence on parole	79.4±1.81	81.4±1.74	79.8±1.80	80.2±1.03	5
*Occupation, first (female)	81.8±8.22	70.6±11.05	80.6±7.10	78.6±4.90	—
*Occupation, longest (female)	86.4±7.32	70.6±11.05	77.4±7.51	78.6±4.90	—
*Occupation, first (male)	66.5±2.16	65.5±2.13	59.1±2.27	63.7±1.27	3
*Occupation, longest (male)	66.9±2.15	67.4±2.13	59.9±2.19	64.8±1.26	3
Number of visits of parolee to supervisor	83.6±1.66	92.8±1.16	62.2±2.17	—	—
Number of visits of parolee to adviser	86.6±1.52	57.3±2.21	35.6±2.14	—	—
Offense committed on parole	98.4± .56	99.0± .45	95.4± .94	98.7± .36c	39
Number of reincarcerations	98.2± .59	98.4± .56	94.6±1.01	98.3± .41c	30
Parole dates, release	99.8± .20	99.2± .40	97.4± .71	99.5± .22c	101
Parole dates, termination	98.6± .53	99.2± .40	96.6± .81	98.1± .35	41

* Sample with fewer than 500 cases. a. Using P=.01 as standard of significance. b. First and third samples. c. Second and third samples. d. First and second samples.

were 30 cases in all the three samples combined where the race designation given by the first group of recorders did not agree with that given by the second group. The amount of information for the three samples combined is 38.

The race of subject's mother was found to be the same, in practically all cases, as that of the father. With respect to religion of father, in the third sample there was complete agreement in 93.4 per cent of the cases with a standard error of 1.11, and in the second sample in 92.6 per cent of the cases with a standard error of 1.17. As not all the three samples were homogeneous, only two and three were combined (symbol c). The percentage of agreement for the combined samples is 93.0 with a standard error of .81. For citizenship of father the percentages of agreement are 95.0, 88.6, and 79.8 in the third, second, and first samples with standard errors of .97, 1.42 and 1.80 respectively. In this item no two samples were homogeneous. Therefore, no comparisons of the samples are shown. The interpretation of all the other entries is identical with that explained above.

A study of the table shows that, by and large, the consistency of the third sample is significantly higher than that of the other two samples which apparently indicates that consistency of recording improved with training. The improvement in consistency is clearly seen from the average percentage of agreement for all the items, excluding those where the number of cases was less than 500. Thus the average percentage of agreement was 85.9 for the third sample with a standard error of 1.16; 80.4 for the second with a standard error of 1.54; and 73.2 for the first sample with a standard error of 1.66. These differences are statistically significant. The standard errors of the differences of these means are as follows: The difference of the average percentage of agreement between the first and second samples is 3.10 times the standard error of the difference. The comparable difference in terms of standard error for the mean of the second sample compared with that of the third is 2.86. The difference between the first and the third samples is 6.21 times the standard error of the difference.

TABLE V

AVERAGE CONSISTENCY OF ALL ITEMS

	Average percentage of agreement (124 items)	Standard error
First sample	73.2	1.66
Second sample	80.4	1.54
Third sample	85.9	1.16

Another interrelation that is apparent from Table IV is that, in general, items that show a high degree of consistency in one sample tend to show a high degree of consistency in the other samples. This can be determined by means of intra-class correlations. The intra-class coefficient for the three samples is .737, the coefficient being highest for samples two and three where its value is .824 and lowest between samples one and three where its value is .604. The correlation between samples one and two gives a coefficient of .787.

To ascertain the extent of consistency in the work of various units throughout the country, a less elaborate scheme has been used. Each unit, after completing the records of the provisionally released cases, was required to re-record 250 cases. The list of cases to be re-recorded was prepared in Washington and was a random selection from all the cases sent in by that unit. The re-recording was done after all the original schedules had been sent to Washington so that in no instance could there be any opportunity to copy from the earlier recording of the cases. At present some 6,000 duplicate recordings have been sent in from the field. Most of them have been edited and coded and some have been punched and are ready for analysis, similar to that made for the three Federal samples.

It is evident that the errors that we have considered are only in part errors of judgment, since inconsistencies found in the jackets would also tend to increase the margin of error. Thus, if a jacket gives three different statements as to the age of an inmate, an occurrence which is by no means rare, such errors will be reflected in the measure of consistency. Therefore, to some extent, errors can be minimized by more accurate and more complete case history material. While most of the errors noted were made at the stage of recording, undoubtedly a certain percentage has been contributed by the subsequent statistical manipulations in coding and tabulating. These latter errors, however, are negligible except in a few items, such as size of community, to which reference has already been made.

In considering the utility of statistical data for parole prediction there is another phase of reliability that must be taken into account. Consistency, measured in terms that have been mentioned here, may not *per se* indicate a high degree of reliability between the information shown in the jacket and the true facts involved in the case. This shortcoming has been fully recognized and efforts were made to include in the budget of the survey adequate funds to make it possible to undertake certain investigative studies to determine empirically the reliability of the information found in the jackets as compared with the existing facts. However, this increase in the budget was not allowed, since such inquiries were regarded as impracticable under the circumstances. Despite this limitation, however, the consistency analysis presented herein would seem to indicate that, in all probability, the statistical data with which we are dealing are sufficiently accurate to be of value in determining the practicability of parole prediction from biographic data, which give information concerning the background of the parolee and the circumstances under which his parole was granted and supervised.

THE MEASUREMENT OF PURCHASING POWER

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In emphasizing the fact that a simple reciprocal relationship does not necessarily exist between measures of the price level and of the purchasing power Dr. Wirth F. Ferger has recently[1] rendered a distinct service. His analysis, however, is less definitive than he appears to believe, and the present note offers criticism of the "true" index of purchasing power which he proposes. Is it a suitable measure of the value of money in the hands of the ultimate consumer? This particular problem is not, to be sure, the only one in which the term purchasing power is used (though possibly the only one in which the concept has much significance), but it is clearly a problem to which a "true" index should be appropriate.

Dr. Ferger's purchasing-power index consists of a weighted average of the reciprocals of price relatives, i.e., a weighted average of the purchasing power of the dollar over each of the several commodities.[2] It has considerable formal appeal, since the elements which are averaged—the changes in "individual" purchasing *powers*—bear directly upon the problem at hand. Looked at more closely, the appeal of the index seems to arise from the fact that it fulfills simply and directly two conditions upon which most of our statistical calculations of purchasing power rest: First, that the purchasing power of money varies inversely with each individual price change; and second, that the effect of each price change be proportional to the "importance" of the commodity in the consumer's budget. But the reciprocal of Laspeyre's price formula or of Paasche's,[3] against which Dr. Ferger argues, also fulfills these two conditions though perhaps not so directly. How shall we choose between them? The formal superiority of Ferger's formula furnishes us with a meagre basis for judgment, and to speak of "bias" in this connection is merely to point out that the indexes give differing numerical results. The matter must be decided in terms of the theoretical purpose underlying the two conditions just cited.

I

Basically, the problem of purchasing power is concerned with the effect of price changes upon the satisfaction which the consumer is able to command. The matter has recently been approached explicitly from this point of view by a number of writers,[4] to whom incidentally Dr. Ferger does not refer. In spite of its ingenuity, one may doubt that such analysis is likely to offer much aid in the organization of actual statistical data, except possibly in very trivial cases; but there can be no question as to the desirability of recognizing fully the nature of the theoretical problem in formulating its empirical treatment.[5] With this end in view, we accept the following two propositions as the basis of discussion: First, the point of the purchasing power problem is an evaluation of the change in the consumer's well being—essentially a judgment upon the change in his satisfaction. Second, since statistical data cannot furnish us with an exact basis for such judgment (human satisfaction not being measurable) the empirical treatment of the problem must be in the nature of an approximation.

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[1] "Distinctive Concepts of Price and Purchasing-power Index Numbers," this Journal, Vol. 31 (June, 1936), pp. 258–272.

[2] Taking u_0 and u_1 as the reciprocals of prices in the two indicated periods and v_0 as the amount spent on each item in the base period, Dr. Ferger's index is expressed (*op. cit.*, p. 270) as $S(u_1/u_0)v_0/Sv_0$.

[3] It will be recalled that Laspeyre's formula is Sp_1q_0/Sp_0q_0 and that Paasche's formula is Sp_1q_1/Sp_0q_1.

In this approximative method of dealing with the problem, it must be recognized that the effect of price changes upon the consumer's position is composed of two elements. In the first place, as the cost of the basket of goods originally purchased increases or declines (as compared with the change in money income if this is not constant) the consumer must reduce, or expand, his purchases. In this sense, his "resources" are changed. In the second place, with the shift in the *relative* prices of commodities, the consumer may be able to distribute his spending more effectively, because of substitutions thus made possible. If this second factor were of no importance—either because there were no changes in the relative price structure (all prices rising or falling in the same proportion), or because such changes had no effect on the consumer's behavior—the problem of measuring purchasing power could be satisfactorily solved. For in such a case, a decline, say, in the cost of the original basket of goods would increase the resources of the consumer with constant money income[6] precisely as would a corresponding addition to his money income, and one could say unequivocally that his purchasing power had increased.

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[4] For a recent bibliography, see Ragnar Frisch, "Annual survey of general economic theory: theory of index numbers," *Econometrica*, Vol. 4 (January, 1936).

[5] The relation of the problem to the aggregates of satisfaction enjoyed by the consumer in the "base" and in the "given" periods is recognised explicitly only by certain writers, but it colors much of the discussion outside of their particular work. For example, the well known index number "tests," being merely restatements of the fundamental laws of arithmetic and hence applicable only to simple aggregates, imply that on the "goods side" of the problem the several qualitatively distinct commodities can be funded by means of some common denominator, in the present case their utility content. The present writer has discussed the matter somewhat more fully elsewhere. See, "Some basic problems in index number theory," in *Economic Essays in Honor of Wesley C. Mitchell*, New York, 1935.

[6] It is simpler to assume constant money income, although precisely the same argument holds if income varies, provided we observe, not merely whether the original basket increases or declines in cost, but whether the change in cost is algebraically greater or less than that in income, both being in relative form.

Conversely, if the original basket of goods increased in cost, his purchasing power would decline. In a word, Laspeyre's index (rather, its reciprocal) measures the change in the consumer's resources; and if we could ignore changes in the relative price structure, it would furnish us with a proper index of purchasing power.[7]

In general, however, changes in relative costs may have an appreciable effect upon the consumer's position, and these must be taken into account. For example, suppose the total cost of the original basket increases although some goods in the basket cheapen. If the latter goods happen to be ready substitutes for those which rise in price, the consumer may maintain or actually increase his well being, in spite of the decline in his "resources," by shifting his spending from the latter to the former items. Thus, the effect of changes in relative prices, when it exists, introduces an ambiguity into the meaning of the calculation of change in the consumer's resources, and it is precisely at this point that our statistical difficulties enter. When the consumer's resources increase, we may be sure that his satisfaction is increased. For the effect of such substitutions as are made possible by the relative-price changes is to increase his satisfaction still further. But with a decline in resources, we could identify the change in satisfaction—and hence in purchasing power—only if we could compare the loss of well being occasioned by the decline in resources with the gain in well being made possible by substitutions.[8]

The ambiguity resulting from the effect of relative-price changes is especially serious even with increases in the consumer's resources if we compare a series of "given" periods with a single base. Suppose that in one of these "given" periods the consumer's resources have increased by ten per cent and in the next by fifteen per cent. Evidently, his purchasing power is greater in both as compared with the base, but we may not conclude that it is greater in the second "given" period as compared with the first. For the relative-price structure may be much more favorable in the first as compared with the second, thus allowing him to enjoy more satisfaction when his resources have increased by ten per cent than he does when they have increased by fifteen per cent.

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[7] The measurement of changes in resources would seem to be the theoretical purpose underlying the two "conditions" cited above as controlling our statistical measurements of purchasing power. Thus, while Dr. Ferger's index seems to fulfill them better from a purely formal standpoint, Laspeyre's formula is the appropriate measure.

[8] It will be recognised that the logic of this proposition is essentially that of Haberler's "upper limit." (G. Haberler, *Der Sinn der Indexzahlen*, pp. 89–90.) A similar analysis based upon Haberler's "lower limit" (*op. cit.*, pp. 90–92) would be equally valid, and would indicate the use of Paasche's formula, instead of Laspeyre's, as a measure of the change in consumer's resources. As a practical matter, however, the quantity data required for Paasche's formula are generally lacking, and for this reason the discussion is concerned solely with the use of Laspeyre's.

It is apparent from the foregoing discussion that Laspeyre's formula[9] tells only part of the purchasing-power story, because the rest is beyond the reach of statistical analysis. A single, accurate measure of purchasing power is out of the question. In spite of this, the conventional fixed-pattern cost-of-living index (Laspeyre's formula) is a useful measure. In the first place, it serves as a good approximation because changes in the consumer's resources probably form a very important part of the price-effect upon the consumer's position, particularly if excessively long-time comparisons are avoided. In the second place, such an index may be used *explicitly* as a first approximation, the interpretation of which is subject to modification in the light of such information as we may have concerning the effect of changes in relative prices. Thus, to take a concrete example, the substantial cheapening of chicken as compared with pork recently observed, together with evidence of actual substitution, should color the conclusions drawn from the cost-of-living index based upon a fixed ratio of consumption of the two. Concerning phenomena like this, our knowledge is all too scanty, but we are certainly not wholly in the dark. The "general characteristics" of the budget items, and such studies as have been and are being made, might, if treated systematically, make possible a very considerable improvement in our treatment of the purchasing power problem. It is by means of such analysis of consumer's purchasing power that we are likely to achieve a more satisfactory solution of the problem than we now have.

How far one can go in taking account of the relative-price component of the problem is not a question that may be answered *a priori*. Furthermore, it is evident that in recognizing this component we have to abandon the neat solution of the problem embodied in a single purchasing-power index, and instead deal with (a) an index which represents only one aspect of the problem, and (b) certain supplementary judgments which, while essentially quantitative in character, are not expressible in explicitly quantitative terms. But this less clear-cut form in which our results must appear simply reflects the quasi-statistical character of the problem, and is thus inevitable.[10]

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[9] The formula is of course rather flexible. The base period, for example, may be much broader than any given period, and in some instances even consist of the entire group of given periods. The one logical requirement is that the base prices should apply to the same period as the quantities of the budget.

[10] In this brief discussion, it is impossible to treat in detail a number of points which may legitimately be raised. One, however, should be mentioned. The argument runs in terms of a single consumer and of changes in his satisfaction. May it be carried over to the practical case of consumer *groups* without bringing in unwarranted assumptions concerning the comparability of satisfaction enjoyed by different individuals? It may be stated that the problem of combining consumers arises only with respect to the statistical representativeness of the measure of consumer's resources, and the general representativeness of the supplementary judgments concerning the effect of relative-price changes.

II

The chief advantage which Dr. Ferger claims for his index is that it implies a suitable consumption pattern. Whereas a price index should be based upon a fixed set of quantities, "a purchasing-power-of-money index must be so calculated that the proportional *expenditure* on the various commodities is maintained . . ."[11] Just why this should be, Dr. Ferger does not tell us[12] and it is argued below that the proposition is not true. We shall, however, ignore the question of validity for the moment, and simply inquire whether such a distinction can actually be made between the two measures under consideration.

In what sense does Laspeyre's formula "assume" constant quantities?[13] Evidently if the consumer actually does purchase the same basket of goods in two periods, Laspeyre's formula is subject to a very simple interpretation—namely, as showing the variation in expenditure. But if the formula can be given an important meaning when the consumer does not maintain the same pattern—such as that offered in the first section of this note—it can no longer be considered as assuming, or being dependent on, invariant quantities. Applying the same test to Dr. Ferger's index, it is easy to show[14] that under conditions of proportionate expenditure the index becomes simply the familiar reciprocal of Paasche's formula.

Whatever the merits of this formula,[15] it is yielded by Dr. Ferger's index only if proportionate expenditures are in fact constant. Such an assumption would be bold indeed. While one may possibly find some items in a typical budget of which the quantities purchased remain approximately constant, and others which absorb an approximately constant proportion of the total expenditure, neither is the case for the general run of items.[16] In brief, any method of measuring purchasing power which depends for its meaning on an assumption as to the character of changes in the consumption pattern is not a useful index, whatever the measure may mean under the particular conditions assumed.

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[11] *Op. cit.*, p. 271. His italics.

[12] It is true that for a *single commodity*, the price expresses the amount of money exchangeable for a fixed physical unit, and the purchasing power (for this particular commodity) expresses the number of physical units exchangeable for a fixed sum of money, a dollar. Possibly it is this distinction for single commodities which Dr. Ferger had in mind.

[13] From a purely formal standpoint, it is true that only one set of quantities (i.e., q_0) appears in Laspeyre's formula, but this is also true of Dr. Ferger's index. (*Ibid.*, p. 270) For the only quantities involved appear in the symbol, $v_0 = p_0q_0$.

[14] Reducing the symbols in his formula (See our footnote 2) to their equivalents in prices and quantities, setting $p_0q_0 = Kp_1q_1$ for each commodity, substituting and cancelling, the result follows.

[15] See footnote 9, above.

[16] No doubt, the change in expenditure on different items varies greatly, if for no other reason than that commodities are substitutes for one another to widely varying degrees.

In view of the foregoing, it would seem that the issue Dr. Ferger raises as to price and purchasing power indexes—that one should be based on constant quantities and the other on proportionate expenditures—is in reality no issue at all. The distinction is not called for by the problem, and the two indexes discussed (Laspeyre's and his own) do not reflect it in any important sense.

While Dr. Ferger does not, as has been noted, make any serious attempt to show why he considers the distinction is called for, he does give us some hint as to the basis for his belief that it characterizes the two indexes. It will be recalled by those familiar with Dr. Ferger's earlier discussion of the problem of averages[17] that he was primarily concerned in that study with the combination of two or more *similar* rates—say, the speeds of automobiles. In averaging such rates, he quite rightly asserted that the arithmetic or the harmonic mean is indicated according as the terms of the problem "hold constant" the variable appearing in the denominator or the numerator of each of the rates. Now prices may be considered as rates, and if we take the same sort of problem—namely, combining *similar* rates—the point is equally valid. Thus, if the price of bread is different in two periods the proper average will be given by the arithmetic mean if the same number of loaves is bought in each, and by the harmonic mean if the same expenditure is made in each. Similarly, one may carry through the same argument for the prices of different commodities, although the results are trivial, being dependent upon the arbitrary choice of physical units. When, however, Dr. Ferger[18] carries over the argument to the problem of combining relatives—i.e., the rates of rates—he is proceeding upon the flimsiest of analogies.

III

Certain additional points may be raised in connection with Dr. Ferger's discussion. While they do not bear directly upon the main problem, they should be mentioned as possible sources of confusion.

1. His unweighted and weighted indexes are not correlatives—the second does not equal the first if all commodities are equally important. Instead of being an unweighted index of purchasing power relatives, his unweighted index is simply the ratio of the "sums" for two periods, of a dollar's worth of each of the several commodities.

2. While Dr. Ferger sees the absurdity of adding ten loaves of bread and twenty apples in computing his unweighted average, he

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[17] "The Nature and Use of the Harmonic Mean," this JOURNAL, Vol. 26 (March, 1931), pp. 36–40.

[18] That this is the basis of his distinction is indicated by his reference to his earlier contribution and his care in showing that his index may be regarded as a weighted harmonic mean of price relatives. *Op. cit.*, pp. 270–271.

gets around the difficulty by expressing all commodities in "homogeneous" units, namely, pounds. (It seems not irrelevant to add that he confines his illustrative material to goods rather than services.) But the "common denominator" implied by the purchasing power problem is human satisfaction, not physical weight—a wage earner who carries home a heavier weekly basket is not better off if the high cost of living is compelling him to purchase coarser and weightier foodstuffs.

3. In setting up his weighted index, Dr. Ferger really gets rid of the problem of arbitrary choice of commercial units by the conventional device of expressing his individual purchasing powers in relative form. But his justification of this procedure is confusing. He develops his weighted index in "aggregative" form,[19] although this appears to be a mere formal manipulation without any real significance.[20] Thus, he is led to make the adjustment for units in the "weights" by which the individual purchasing powers are multiplied. "A perfect corrective factor for the weights is the price (dollars per unit) in the base year p_0, or $1/u_0$. The complete weights are, then, v_0/u_0, which give an accurate measure of the importance of the commodities when their prices (sic) are stated in u's—so many units to the dollar."[21] This seems scarcely an illuminating way in which to put the matter.

REPLY

BY WIRTH F. FERGER

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I WELCOME the opportunity afforded by Professor Lewis' criticisms to clarify the treatment of certain aspects of the measurement of the purchasing power of money which were treated in my article. With much of his analysis I find myself in substantial agreement. About half of the note concerns a problem which my article did not purport to discuss, however, and should be considered on its own merits.

Dr. Lewis comments that the concept of a purchasing-power index which I developed "has considerable formal appeal," but is less definitive than I appear to believe. If by "formal" he means "theoretical," implying that other aspects of any problem to which a purchasing-power index is to be applied require consideration in addition to the strictly logical characteristics of the basic concepts employed, I am in hearty agreement. The title of my article explicitly limited its scope to examining the theoretical aspects of the "distinctive *concepts* of price and purchasing-power index numbers." It may or may not be true that my analysis will "offer [little] aid in the organization of actual statistical data, except possibly in very trivial cases;" but if my contentions concerning the nature of the *concepts* involved are accurate, they should be expected to have some meaningful application to practical problems. Dr. Lewis' opening sentence apparently accepts my central thesis.

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[19] See the left-hand side of his second equation. *Op. cit.*, p. 270.

[20] In the case of certain (simple) price and quantity indexes it is often useful to convert the weighted index of relatives into aggregative form largely because the latter always turns out to be a ratio of money sums. The latter being a definite concept, the aggregative expression may aid in determining the exact meaning of the index in question. But there is no corresponding interpretation of Dr. Ferger's "aggregative," and it is interesting to note that his own subsequent discussion of the index is confined to the average-of-relatives form.

[21] *Op. cit.*, pp. 269–270.

Professor Lewis tests the general validity of my analysis by applying it to the measurement of the value of money in the hands of the ultimate consumer. He recognizes that "this particular problem is not, to be sure, the only one in which the term purchasing power is used (though possibly the only one in which the concept has much significance), but it is clearly a problem to which a 'true' index should be appropriate." Perhaps my use of the word "true" was unfortunate: certainly a connotation has been read into the word which was not intended. The word was used merely in contrast with the "pseudo" index of purchasing-power (the reciprocal of a price index) from which my formula was to be distinguished. Certainly after myself criticizing the search for a "universal" or an "ideal" formula, I intended no exclusive or universal implication in the word "true." Still, Professor Lewis is correct in asserting that general principles developed with respect to purchasing-power indexes should be applicable to any problem truly involving the measurement of the value of money. He then tests the principles as applied to the problem of consumers' standards of living, justifying this test by the assertion that the chief advantage which I claim for my index "is that it implies a suitable consumption pattern." I can find no statement in my article which would lend itself to this interpretation.

Most of Professor Lewis' criticism flows from his assertion that "Basically, the problem of purchasing power is concerned with the effect of price changes upon the satisfaction which the consumer is able to command." No analysis is given in support of this point of view, and I regard this as too narrow an approach to the measurement of the purchasing power of money. Money is used for many purposes other than expenditure by consumers; in fact, the volume of transactions represented by the purchase of goods and services by consumers undoubtedly forms a minor part of the total volume of monetary transactions in this country. I am, therefore, unable to accept the first proposition offered in Section I of the criticism that "the point of the purchasing power problem is an evaluation of the change in the consumer's wellbeing—essentially a judgment upon the change in his satisfaction." In fact, it seems to me that the problem of the wellbeing of the consumer is more concerned with the consideration of budgets and prices, and the possibility of substitution among commodities, than it is with the purchasing power of money as such. Since I do not accept his basic propositions, detailed comment on that part of his analysis based thereon is inappropriate. Dr. Lewis' analysis in the first section of his comments constitutes an interesting attack on an important problem, and one with which I have much sympathy and agreement; it is not, however, a criticism of my study.

Just as unintended connotations were read into my use of the word "true," may I also disclaim the interpretation placed on my use of the word "bias." Dr. Lewis states, " . . . to speak of 'bias' in this connection is merely to point out that the indexes give differing numerical results." I myself made this same objection to the judgment of a formula on the basis of its simple comparison with some other one (p. 266). When I used the word (at the bottom of p. 267), the context was intended to give it quite a different connotation. My statement was that "Equal original weights of one unit each do not actually result in an equally weighted index number system, but one biased in the direction of the price changes [these being of equal percentage amount but of opposite direction] of the commodity or commodities which have become relatively more expensive." This referred to a *demonstrated* preponderance of effect of one price change purportedly equal to another, and pointed out the *source* of the numerical difference in results, rather than merely indicating its existence.

In the second section of his notes, Professor Lewis directs certain criticisms against specific points of my analysis which merit comment. After noting that I maintain that "a purchasing-power-of-money index must be so calculated that the proportional *expenditure* on the various commodities is maintained, rather than assuming constant quantities purchased," he comments, "Just why this should be, Dr. Ferger does not tell us . . . " At another place, he claims that I do not "make any serious attempt to show why [I consider] the distinction is called for." In defense, I point out that at two places I do discuss the relationship between my treatment and the economic theory relating to the nature and functions of money and prices. In Section III of my article, dealing with the concept of purchasing power, I state, "Prices, being money ratios, have several aspects, corresponding to the different functions performed by money." (p. 263.) Likewise, the final section of my paper (Section V) consists of an attempt briefly to suggest the application to economic theory of the differentiation I had analyzed in detail. Criticisms should not completely ignore relevant sections of the analysis toward which they are directed.

Lewis goes on to say that my reference to my previous article apparently gives a hint as to my reason for preferring, for the index of the value of money, a formula which is equivalent to the reciprocal of the weighted harmonic mean of prices in their usual form. After a short discussion, recognizing the different assumptions implicit in averaging rates by the use of the arithmetic and harmonic means, Professor Lewis dismisses this whole reasoning by asserting that when one carries over the argument "to the problem of combining relatives—i.e., the rates of rates—he is proceeding upon the flimsiest of analogies." This objection has been discussed by others, and a reply suggested by Geo. R. Davis in the 1932 "Proceedings Supplement" of this JOURNAL (pp. 60–61). The derivation of my formula was, however, based on no such "analogy," and did not in fact involve the use of the harmonic mean. It was only after developing the formula in aggregative form that its identity with the reciprocal of the harmonic mean of relatives was pointed out: "a second method of viewing the whole matter of formula and weights." The validity of this formula thus rests on no "analogy."

It should be pointed out, however, that all average-of-relatives price index numbers rest on just as "flimsy" a basis. What are the implicit assumptions of the ordinary *arithmetic* average-of-relatives price formula? Does it really show the varying price of a constant bill of goods? I have been unable to accept the strictures against carrying the principles of the averaging of rates over into the problems of averaging rates of rates. A complaint against the use of the harmonic mean in this case, however, applies equally against the arithmetic mean, unless we are to fall into the error of accepting the commonplace without question, while objecting to the novel.

At another place, after noting the tacit assumption of the harmonic formula of constant proportional expenditures, Dr. Lewis points out that "In brief, any method of measuring purchasing power which depends for its meaning on an assumption as to the character of changes in the consumption pattern is not a useful index, whatever the measure may mean under the particular conditions assumed." Let me point out again that *some* assumption is always implicit in every formula based on a single set of weights, concerning the character of the changes (or lack of change) in quantities accompanying the observed price movements. The arithmetic mean of relatives with constant weights assumes *unchanging amounts* just as truly as the harmonic assumes unchanged proportional *expenditures.* Professor Lewis believes an assumption of constant proportionate expenditures "would be bold indeed." It is my conviction that an assumption of constant quantities purchased, as prices vary, is many times bolder, as applied to the general run of commodities and services. This latter assumption challenges, in fact, the basic function of the price system as a regulator of consumption. It assumes that prices mean nothing when consumers go into the market to make their purchases. It seems to me to require little analysis to show that a constant-expenditure demand curve comes closer to reality for consumers' goods than does a vertical or completely inelastic demand curve, which is the assumption implied by the arithmetic average.

This is all beside the point, however, since my discussion related, not to the "consumption standard," but to the conceptual meaning of an index of the purchasing power of money. The analysis made no assumption whatever as to the way money is actually spent by consumers or anyone else. My point was simply that if we are trying to measure changes in the quantities of goods a given amount of money will buy over periods of changing prices, we must measure just this, keeping invariant other factors such as changing consumer habits. The money must be spent on the various commodities in constant proportions, and measurements made of the changes in the average quantities received for this money.

I come now to the last three specific comments of Professor Lewis. He points out that the "unweighted and weighted indexes are not correlatives—the second does not equal the first if all commodities are equally important." This appears to be a valid "formal" criticism of these formulas, which I had not noticed. I do not know whether or not this indicates some fallacy in one or the other. The unweighted index has, of course, no practical value since it could be applied only to articles expressed in homogeneous units—and I fully realize that no physical units are truly homogeneous as between different commodities. A pound of coal is not comparable with a pound of butter, as was noted in my paper. I developed this unweighted formula only as an expository tool, and gave no further attention to it after passing to the problem of the weighted index. There may be some simple algebraic explanation for the non-correlative nature of these two formulas, which has escaped me so far.

The second of the final criticisms concerns the unweighted index and loses its force when this index is considered merely as an expository device. It is noted that I confined my illustrations to goods rather than including services. In the weighted index, however, it is obvious that the prices of services could easily be accommodated, man-hours of service being included along with the diverse commodity units of pounds, quarts, and yards. The statement, "But the 'common denominator' implied by the purchasing power problem is human satisfaction, not physical weight . . . " has already been challenged.

The final criticism is that my procedure of first developing the weighted index in aggregative form before expressing it as an average-of-relatives "is confusing." I am not the one to judge the accuracy of the charge of unskillful presentation. An exposition by means of concrete numerical examples is not as elegant as one couched in terms of algebraic symbols and mathematical transformations, and based on quoted theorems. I preferred, however, to attempt to make the explanation intelligible to non-mathmatical readers by first developing simple numerical illustrations, as well as hoping that the analysis would carry more conviction through a more thorough understanding than would ordinarily be assimilated from an elegant mathematical derivation.

The last few lines of the criticism appear again to suggest uncritical acceptance of the commonplace and repugnance to the unfamiliar. By inserting the word "sic" in a quotation from my study, Dr. Lewis apparently regards as an error my reference to "so many units to the dollar" as representing true *prices*. As I tried to point out in my earlier article,[1] prices, being ratios between units of commodities and units of a standard, can be expressed in either one of two forms, neither one of which can be regarded as any more arbitrary than the other. There are places where some prices are commonly quoted in terms of quantities obtainable for a unit of money. In India, for instance, the price of flour may be "7 sehrs to the Rupee" and at a later time may *rise* to "6 sehrs to the Rupee." If our prices were customarily expressed in this form and our price index formulas had developed with the use of the familiar arithmetic mean of relatives, the result would be exactly that yielded by the harmonic mean of prices as we do actually quote them. Unless this basic idea is grasped, and either accepted or refuted, further discussion is futile.

[1] "The Nature and Use of the Harmonic Mean," this JOURNAL, Vol. 26 (March, 1931), pp. 36–40.

THE CONCEPT OF CONFIDENCE OR FIDUCIAL LIMITS APPLIED TO THE POISSON FREQUENCY DISTRIBUTION*

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THE IDEA of the fiducial interval, introduced by R. A. Fisher,[1] has provided the key to the solution of some statistical problems of a type which formerly resisted analysis. As developed by J. Neyman,[2] it has resulted in the definition of the concept of "confidence belts" corresponding to different "confidence coefficients," for various frequency distributions. Clopper and Pearson[3] make use of these concepts to calculate, for certain specified degrees of confidence, the limits of estimates of the composition of a population which follows the binomial frequency distribution, when each such estimate is calculated from the composition of a single small sample: A sample of n units drawn from a large population contains x units having a certain character A; p is the proportion of A-units in the population. If x/n is used as an estimate of the value of p, the limits between which p is likely to lie, for two different degrees of confidence, are shown in figures 4 and 5 of their paper.

The application of the same method to the caluclation of similar limits for the Poisson frequency distribution appears to offer no obstacles, and the limits so obtained form a valuable supplement to those for the binomial.

METHOD OF CALCULATION

A large population has a *small* fraction p of its units bearing character A. A fairly large sample of n units is taken at random and the number x of A-units in it is enumerated. The chance of occurrence of different values of x will be given more and more accurately by the terms of the Poisson distribution:

$$e^{-m}\left(1 + m + \frac{m^2}{2!} + \frac{m^3}{3!} + \cdots\right) \tag{1}$$

$(m = np)$, as $p \rightarrow 0$ and $n \rightarrow \infty$.

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* This subject has been treated by F. Garwood under the title "Fiducial Limits for the Poisson Distribution" in *Biometrika* 28 (1936) 437–442, which came to the attention of the Editor after this article was accepted for publication. Dr. Ricker's presentation appeared to be sufficiently different to warrant the publication of this article according to the original decision.—*Ed.*

[1] Fisher, R. A. "Inverse probability." *Proc. Camb. Phil. Soc.* 26 (1930), 528.

[2] Neyman, J. Note I to paper "On the two different aspects of the representative method." *Journ. Roy. Stat. Soc.* 97 (1934), 589–593.

[3] Clopper, C. J., and E. S. Pearson. "The use of confidence or fiducial limits applied to the case of the binomial." *Biometrika* 26 (1934), 404–413.

For a given value of m, find now the term x_1 in this frequency distribution such that the sum of the terms from x_1 to infinity is equal to or less than 0.025, while the sum from (x_1-1) to infinity is greater than 0.025; or briefly:

$$\Sigma(m;\, x_1 \cdots \infty) \leqq 0.025 < \Sigma(m;\, \overline{x_1 - 1} \cdots \infty). \tag{2}$$

Similarly find the term x_2 such that the sum of all terms from 0 to x_2 is equal to or less than 0.025, while the sum from 0 to (x_2+1) is greater than 0.025; or briefly:

$$\Sigma(m;0 \cdots x_2) \leqq 0.025 < \Sigma(m;0 \cdots \overline{x_2 + 1}). \tag{3}$$

If such points x_1 and x_2 be determined for all values of m from 0 upwards, and they be plotted as in the accompanying figure, a pair of stepped lines is obtained, the steps occurring because of the fact that x_1 and x_2 values must be integral. Points on these lines satisfy conditions (2) and (3) above; it follows therefore that in the long run of statistical experience, from whatever populations following a Poisson distribution samples are drawn, we may expect at least 95 per cent of points (x, m) will lie inside the boundaries of the stepped belt, and

CONFIDENCE BELT FOR COEFFICIENT ·95.

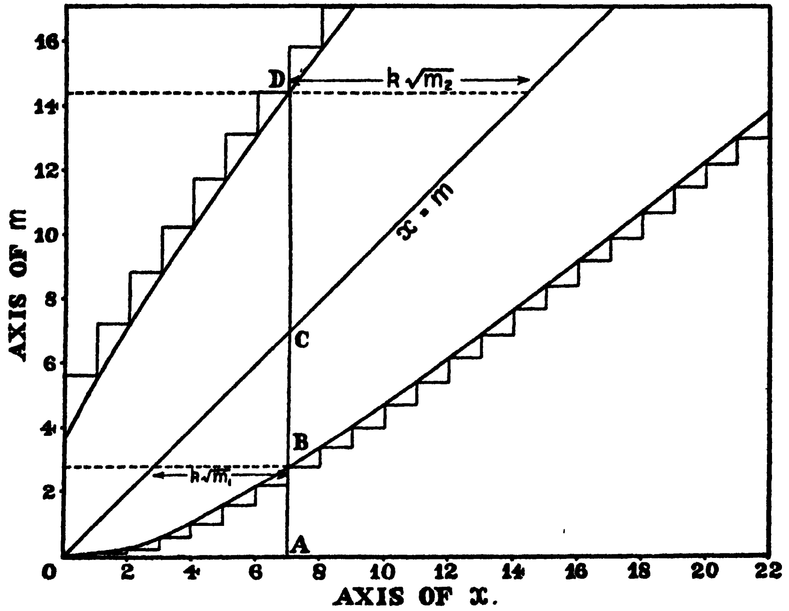

Diagram illustrating confidence limits for Poisson distributions, and Professor Pearson's approximation thereto calculated from the normal distribution. It should be noted that the approximation need be used only when x is greater than 50 (the limit of the accompanying table) and would be of little value with x = OA = 7, as shown here for purposes of illustration.

not more than 5 per cent on or outside the boundary. If curves be drawn as in the figure joining the inside corner points of the boundaries, they will serve equally as well as the stepped lines (since x values are always integral) to obtain *confidence* or *fiducial limits* for m, associated with a confidence coefficient of 0.95. In the same way, confidence limits may be calculated and plotted, corresponding to other confidence coefficients.

Limits of confidence so calculated may be applied to any unique random sample which a priori knowledge or accumulated experience demonstrates to be a member of a series having a Poisson frequency distribution. Failing these, internal evidence of such membership may be consulted: i.e. since the Poisson form obtains when p is small, is in a sample x/n (which is an estimate of p) be small, then the distribution to which it belongs may safely be considered Poisson. *How* small x/n must be in such a case is partly a matter of taste; the writer considers values up to 0.01 above suspicion, while values as large as 0.05 may be accepted, with greater circumspection. Another rule, having about the same import, is to use these Poisson limits when the limits given on Clopper and Pearson's binomial charts become difficult to read, by reason of the small size of x/n.

In calculating fiducial limits as above, use was made of H. E. Soper's table[4] of the general term of Poisson's exponential expansion, and of Lucy Whitaker's table[5] of the same. The first-mentioned proceeds from $m=0.1$ to $m=15.0$ by tenths, the second from $m=1$ to $m=30$ by units. In Soper's table, probabilities corresponding to successive x-values were added at each end of the series, until the sum amounted to 0.005 or 0.025, corresponding to confidence coefficients of 0.99 and 0.95 respectively. In general, the terms would not add to exactly these quantities, but it was possible to choose the m-value which came closest to doing so, and interpolation would give this limiting value to the nearest hundredth. Whitaker's table was more convenient in that the addition was already performed, but the coarser grouping of m-values made it necessary to interpolate to get the limiting value to the nearest tenth. This could be done in the table itself, or more conveniently by interpolating between limiting values, choosing a few which were accurately known, as base points. The one method was used to check the other. Neither table however covered the whole range necessary to take the fiducial table up to $x=50$, so calculations of the necessary parts of the Poisson series were made for m-values up to $m=71$, limits found by addition as before, and the table filled in by extensive interpolation. It is believed that this method has provided a table having the first decimal place accurate or nearly so.[6]

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[4] *Biometrika* 10 (1918), 25.

[5] *Biometrika* 10 (1918), 36. Both tables are reprinted in *Tables for Statisticians and Biometricians*, 2nd Edition, Part 1. Cambridge University Press.

The table proceeds only to $x=50$, this being a somewhat arbitrary limit, dictated by the time available for its calculation. But since the rule must by definition apply to the whole of statistical experience, any such limitation of x-values is theoretically unsound. Professor E. S. Pearson of University College, London, who pointed this out to the writer, at the same time suggested a rough method of extrapolating the table, which is as follows: "As m increases the Poisson distribution can be more and more closely represented by a normal curve. Thus in the notation used above we shall have approximately

$$\Sigma(m; x_1 \cdots \infty) = \int_k^\infty \frac{1}{\sqrt{2\pi}} e^{-t^2/2} dt \tag{4}$$

$$\Sigma(m;\ 0 \cdots x_2) = \int_{-\infty}^k \frac{1}{\sqrt{2\pi}} e^{-t^2/2} dt \tag{5}$$

where k is the ratio of the deviation from the mean to the desired point, over the standard deviation. Thus in the first integral $k=(x_1-m_1)/\sqrt{m_1}$, and for the second $k=(m_2-x_2)/\sqrt{m_2}$. To make the expressions in (4) and (5) equal 0.025 we should take $k=1.9600$, and to make them equal 0.005 take $k=2.5758$.

"The diagram shows the confidence belt with the coefficient 0.95. For an observed value $x=OA=AC$ we have $m_1=AB$, $m_2=AD$. Further, $BC=x-m_1=k\sqrt{m_1}$; $DC=m_2-x=k\sqrt{m_2}$.

Or,

$$\begin{cases} m_1^2 - m_1(2x+k^2) + x^2 = 0 \\ m_2^2 - m_2(2x+k^2) + x^2 = 0 \end{cases}$$

so that

$$\begin{cases} m_1 = x + k^2/2 - k\sqrt{k^2/4+x} \\ m_2 = x + k^2/2 + k\sqrt{k^2/4+x} \end{cases}$$

Using the values of k given above, we find that for confidence coefficient 0.95,

$$(m_2, m_1) = x + 1.92 \pm 1.960\sqrt{x+1.0} \tag{6}$$

and for confidence coefficient 0.99,

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[6] A paper in *Biometrika* 27 (1935), 273–292, by J. Prsyborowski and H. Wileński, entitled "Statistical principles for routine work in testing clover seed for dodder," contains the upper fiducial limits for confidence coefficient 0.99 ($\alpha = 0.995$ in their notation). They are however calculated quite differently, and more accurately, from the table of the Incomplete Gamma Function. The agreement of our values with theirs is not exact, but shows only minor differences: usually 0.1 greater. in one case 0.2. The authors quoted give no *lower* limits.

$$(m_2, m_1) = x + 3.32 \pm 2.576\sqrt{x + 1.7}. \qquad (7)''$$

Example: At $x = 50$, how do confidence limits so calculated compare with those in the table?

Confidence coefficient	0.95		0.99	
	Lower Limit	Upper Limit	Lower Limit	Upper Limit
From equations (6) and (7)	37.9	65.9	34.8	71.8
From the table	37.0	65.9	33.6	71.3
Old method	36.1	63.9	31.8	68.2

It is evident that even at $x = 50$ this method gives confidence limits of sufficient accuracy for ordinary purposes, and better approximation can be expected as x increases.

It should be noticed that a different method of dealing with this problem has been in use for some time. When in a sample x was found to be fairly large, it was considered as an estimate of the mean, hence also of the variance, of the Poisson distribution to which it belonged. Limits of probability corresponding to our 0.95 confidence coefficient were then calculated from the formula

$$(m_2, m_1) = x \pm 1.960\sqrt{x}$$

which is tantamount to assuming $BC = CD = k\sqrt{x}$ in the figure. Limits so calculated have been entered at the foot of the schedule above. It is evident that taken as a whole they are a much poorer estimate of the true limits of confidence than are those calculated by Professor Pearson's method.

EXAMPLES OF USEFULNESS

The accompanying table may be used in all cases where the Poisson distribution is appropriate—i.e., in cases where p (the fraction of "successes") is small. In a few cases either the Poisson limits or the binomial limits of Clopper and Pearson may be successfully used; the limits in such cases occupy the lower left corner of their charts.

Example 1. A sample of 100 ($= n$) taken from a large run of migrant sockeye salmon contains 5 ($= x$) which are two years old, the remainder being yearlings. The best estimate of the proportion p of two-year-olds in the total run is $5/100 = 0.05$. Between what limits may we be confident the value of p lies?

Adopting the 0.99 confidence coefficient, and referring to the table, we may be almost certain that the proportion of second year fish is not less than $1.0/100 = 0.010$, and not greater than $14.1/100 = 0.141$. Reference to the binomial chart gives limits of 0.02 and 0.13, as nearly as they can be read.

FIDUCIAL OR CONFIDENCE LIMITS FOR POISSON FREQUENCY DISTRIBUTIONS

x	Confidence coefficient				x	Confidence coefficient			
	0.99		0.95			0.99		0.95	
	Upper Limit	Upper Limit	Lower Limit	Upper Limit		Lower Limit	Upper Limit	Lower Limit	Upper Limit
0	0.0	5.3	0.0	3.7					
1	0.0	7.4	0.1	5.6	26	14.7	42.2	17.0	38.0
2	0.1	9.3	0.2	7.2	27	15.4	43.5	17.8	39.2
3	0.3	11.0	0.6	8.8	28	16.2	44.8	18.6	40.4
4	0.6	12.6	1.0	10.2	29	17.0	46.0	19.4	41.6
5	1.0	14.1	1.6	11.7	30	17.7	47.2	20.2	42.8
6	1.5	15.6	2.2	13.1	31	18.5	48.4	21.0	44.0
7	2.0	17.1	2.8	14.4	32	19.3	49.6	21.8	45.1
8	2.5	18.5	3.4	15.8	33	20.0	50.8	22.7	46.3
9	3.1	20.0	4.0	17.1	34	20.8	52.1	23.5	47.5
10	3.7	21.3	4.7	18.4	35	21.6	53.3	24.3	48.7
11	4.3	22.6	5.4	19.7	36	22.4	54.5	25.1	49.8
12	4.9	24.0	6.2	21.0	37	23.2	55.7	26.0	51.0
13	5.5	25.4	6.9	22.3	38	24.0	56.9	26.8	52.2
14	6.2	26.7	7.7	23.5	39	24.8	58.1	27.7	53.3
15	6.8	28.1	8.4	24.8	40	25.6	59.3	28.6	54.5
16	7.5	29.4	9.2	26.0	41	26.4	60.5	29.4	55.6
17	8.2	30.7	9.9	27.2	42	27.2	61.7	30.3	56.8
18	8.9	32.0	10.7	28.4	43	28.0	62.9	31.1	57.9
19	9.6	33.3	11.5	29.6	44	28.8	64.1	32.0	59.0
20	10.3	34.6	12.2	30.8	45	29.6	65.3	32.8	60.2
21	11.0	35.9	13.0	32.0	46	30.4	66.5	33.6	61.3
22	11.8	37.2	13.8	33.2	47	31.2	67.7	34.5	62.5
23	12.5	38.4	14.6	34.4	48	32.0	68.9	35.3	63.6
24	13.2	39.7	15.4	35.6	49	32.8	70.1	36.1	64.8
25	14.0	41.0	16.2	36.8	50	33.6	71.3	37.0	65.9

Foerster[7] has already made use of the Poisson limits in cases like the above.

Fiducial limits for the Poisson distribution may also be used in cases of a type where those for the binomial are not applicable. In such cases p and x are known, but not m $(=np)$. We wish to know the limits of confidence which attach to x when it is used as an estimate of m, or more rarely to x/p as an estimate of n. This situation arises whenever the density of particles suspended in a fluid is estimated by counting the number taken in a small known volumetric fraction of it. The writer has already published[8] an example of this taken from the field of plankton enumeration—the field in which it was originally developed. The hypothetical illustration to follow pertains to quite a different situation, but the treatment is identical.

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[7] Foerster, R. E. "An investigation of the life history and propagation of the sockeye salmon (*Oncorhynchus nerka*) at Cultus Lake, British Columbia." No. 5. *Journ. Biol. Board Can.* 2 (3) (1936), 311–333.

[8] Ricker, W. E. "Statistical treatment of sampling processes useful in the enumeration of plankton

Example 2. In the course of studies of hay-fever infections, counts were made of the quantity of pollen in the atmosphere. In one test, pollen was filtered from 1 cc. of air, and the number of grains present counted as 45. The density of pollen in the atmosphere near this point may be estimated as 45 grains per cc. What confidence may be placed in this estimate?

Obviously the applicability of Poisson fiducial limits in such a case hinges upon a demonstration that the numbers of pollen grains in successive samples constitute a Poisson frequency distribution. This may be done most easily by thinking of the volume of air under consideration as containing a large number N of cubic centimeters, throughout which pollen grains are randomly mixed; the total number n of pollen grains in this volume is great, but not so great that crowding or cohesion might make their distribution other than random. For each individual grain, the chance of occurring in the 1 cc. sample is $1/N$; the chance of its being missed is $(1-1/N)$. The distribution of numbers of pollen grains in a great number of 1 cc. samples (the earlier samples being replaced in turn) is of the binomial form: $\{(1-1/N)+1/N\}^n$. We know $1/N$ is small; call it p. Putting $m=np$, this binomial distribution may therefore conveniently be represented by the Poisson distribution. Hence, when only a single sample is at hand, the reliability of the number of grains x in it as an estimate of the number of grains m *per cc.* in the whole volume may be found from the table of fiducial limits for Poisson distributions.

It may be well to repeat the conditions upon which this demonstration is based; which are (1) that the units being enumerated are randomly distributed throughout the medium, and (2) that the volume (or area, etc.) of the medium taken in the sample be small in relation to the volume not so taken.

Return now to the example. The number of grains counted, x, is 45. Adopting the 0.95 confidence coefficient and referring to the table, the probable limits of m are 32.8 and 60.2. We may therefore say at once that the abundance of pollen in the region sampled is probably between 33 and 60 grains per cubic centimeter.

Example 3. A sample dredged from 500 square centimeters of the bottom ooze in the deep water of a certain lake contains 80 organisms

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organisms." *Archiv. f. Hydrobiol.* 31 (1937), 68–84. It may be noticed that in this paper the formulae corresponding to (6) and (7) above were calculated somewhat differently, but give nearly the same results.

of a certain species. Previous experience on such lakes has shown that such organisms are likely to be randomly distributed over the ooze surface. What were the probable limits of abundance of the organism in question when the sample was taken?

Adopting the 0.95 confidence coefficient, and putting $x=80$ in formula (6) above, we obtain

$$m_1=64.3, \qquad m_2=99.6$$

The density of the organisms probably lies between 64 and 100 per 500 square centimeters, or between 1280 and 2000 per square meter.

ACKNOWLEDGMENT

The writer has received greatest assistance in the preparation of the fiducial table from Mr. J. W. Hopkins, of the National Research Council, Ottawa, Canada. Professor E. S. Pearson of University College, London, read the manuscript and made valuable suggestions, as well as offering the independent contribution noted in the text.

NOTES

ON THE ELIMINATION OF VARIABLES IN MULTIPLE CORRELATION

IN HIS recent paper which appeared in this JOURNAL, Waugh treated the problem of eliminating variables by means of adjoint determinants. In the following pages, we shall show that the same problem may be treated in an elementary manner by using only the four operations—addition, subtraction, multiplication, and division.

I. THEORY

For simplicity, let us consider a problem of four variables. *Let r_{ij} be the simple correlation coefficients, and let s_{ij} satisfy the following 4^2 equations:*

$$\sum_{j=1}^{4} r_{ij}s_{jk} = \begin{cases} 1 & (i=k) \\ 0 & (i\neq k) \end{cases} \qquad (i, k=1, 2, 3, 4). \tag{1}$$

Then the multiple regression equations are

$$\begin{aligned} s_{11}z_1+s_{12}z_2+s_{13}z_3+s_{14}z_4&=0,\\ s_{21}z_1+s_{22}z_2+s_{23}z_3+s_{24}z_4&=0,\\ s_{31}z_1+s_{32}z_2+s_{33}z_3+s_{34}z_4&=0,\\ s_{41}z_1+s_{42}z_2+s_{43}z_3+s_{44}z_4&=0, \end{aligned} \tag{2}$$

where $z_i=x_i/\sigma_i$, x_i being measured from its mean.

If we divide the first, second, third, and fourth equations by $-s_{11}$, $-s_{22}$, $-s_{33}$, $-s_{44}$, we obtain the usual multiple regression equations expressed in terms of β_{ij}.

Without losing any generality, let us suppose z_1 is to be eliminated. Multiplying the first equation of (2) by $-1/s_{11}$, we secure

$$-z_1+\beta_{12}z_2+\beta_{13}z_3+\beta_{14}z_4=0. \tag{3}$$

Now multiplying equation (3) by s_{21}, s_{31}, s_{41} and adding to the second, third, and fourth equations in (2) respectively, we obtain

$$\begin{aligned} (s_{22}+s_{21}\beta_{12})z_2+(s_{23}+s_{21}\beta_{13})z_3+(s_{24}+s_{21}\beta_{14})z_4&=0,\\ (s_{32}+s_{31}\beta_{12})z_2+(s_{33}+s_{31}\beta_{13})z_3+(s_{34}+s_{31}\beta_{14})z_4&=0,\\ (s_{42}+s_{41}\beta_{12})z_2+(s_{43}+s_{41}\beta_{13})z_3+(s_{44}+s_{41}\beta_{14})z_4&=0, \end{aligned} \tag{4}$$

which are the required multiple regression equations when z_1 is eliminated.

II. PRACTICAL PROCESS

In practical computation, we are interested only in the coefficients of the variables. Thus, we may put down the coefficients s_{ij} of z_j in equations (2) as follows:

$$\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & s_{11} & s_{12} & s_{13} & s_{14} \\ 2 & & s_{22} & s_{23} & s_{24} \\ 3 & & & s_{33} & s_{34} \\ 4 & & & & s_{44} \end{array} \tag{5}$$

Multiplying the first row by $-1/s_{11}$, we obtain the first row in (6):

$$-1,\ \beta_{12},\ \beta_{13},\ \beta_{14}\,.$$

If we multiply these numbers by s_{21}, s_{31}, s_{41} and add to the second, third, and fourth rows respectively, we obtain

$$\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & -1 & \beta_{12} & \beta_{13} & \beta_{14} \\ 2 & 0 & (s_{22}+s_{21}\beta_{12}) & (s_{23}+s_{21}\beta_{13}) & (s_{24}+s_{21}\beta_{14}) \\ 3 & 0 & & (s_{33}+s_{31}\beta_{13}) & (s_{34}+s_{31}\beta_{14}) \\ 4 & 0 & & & (s_{44}+s_{41}\beta_{14}) \end{array} \tag{6}$$

The numbers in the last three rows and three columns are symmetric, and hence the numbers below the principal diagonal may be omitted.

If we wish to eliminate z_3, and also wish to determine the regression equations of z_1 on (z_2, z_4), and of z_2 on (z_1, z_4), we then rearrange the table of numbers (5) as follows:

$$\begin{array}{c|cccc} & 3 & 1 & 2 & 4 \\ \hline 3 & s_{33} & s_{31} & s_{32} & s_{34} \\ 1 & & s_{11} & s_{12} & s_{14} \\ 2 & & & s_{22} & s_{24} \\ 4 & & & & s_{44} \end{array} \tag{7}$$

The last row of numbers may be omitted since we are not interested in the regression equation of z_4 on (z_1, z_2). We now apply the method for computing the numbers in Table (6).

This method is theoretically the well known Gauss method of elimination. A mechanical process of carrying out Gauss' method has been given by Doolittle. The latter method gives a check sum to ascertain our computation in each step. The method is so very familiar to many students in social sciences that it is almost trifling to illustrate it.

III. NUMERICAL EXAMPLE

Let the simple correlation coefficients be

$$
\begin{array}{c|cccc}
 & 1 & 2 & 3 & 4 \\
\hline
1 & 1 & .25 & .64 & .40 \\
2 & & 1 & .32 & -.50 \\
3 & & & 1 & .16 \\
4 & & & & 1
\end{array}
\tag{8}
$$

Then the set of s_{ij} satisfying equations (1) is as follows:

$$
\begin{array}{c|cccc}
 & 1 & 2 & 3 & 4 \\
\hline
1 & 2.371574 & -0.864536 & -1.047016 & -1.213375 \\
2 & & 2.022237 & -0.319091 & 1.407987 \\
3 & & & 1.776188 & -0.024929 \\
4 & & & & 2.193332
\end{array}
\tag{9}
$$

We wish to eliminate the variable z_3. The computation process is given below.

TABLE 10

	−R	3	1	2	4	Sums	Check
3a	−.56300351	1.7761879	−1.0470160	−0.3190906	−0.0249290		.3851523
3b		−1	.5894737	.1796491	.0140351	−.2168421	−.2168421
1a			2.3715743	−0.8645361	−1.2133752		−.7533529
1b			−.6171884	−0.1880955	−0.0146950		.2270372
1c			*1.7543860*	*−1.0526316*	*−1.2280702*	−.5263158	−.5263158
1d	−.57		−1	.60	.70	.30	.30
2a				2.0222366	1.4079872		2.2465972
2b				−.0573243	−.0044785		.0691923
2c			*−1.0526316*	*1.9649123*	*1.4035088*	2.3157895	2.3157895
2d	−.50892857		.5357143	−1	.7142857	.25	.25
4a					2.1933323		2.3630154
4b					−.0003499		0.0054056
4c			*−1.2280702*	*1.4035088*	*2.1929825*	2.3684211	2.3684210
4d	−.456		.56	.64	−1	.20	.20

In Table (10), the underlined numbers are the coefficients s'_{ij} of z_1, z_2, z_4 when the variables z_3 has been eliminated. Expressing the multiple regression equations in terms of β's, we have

$$
\begin{aligned}
z_1 &= .60z_2 + .70z_4,\\
z_2 &= .53571z_1 + .71429z_4,\\
z_4 &= .56z_1 + .64z_2.
\end{aligned}
$$

If we are not interested in the last equation, the computation in lines 4a, 4b, 4c, 4d may be omitted.

Observe that this method may be applied to obtain the standard error function of a regression equation. For a description of this method (without mathematical demonstration), the reader is referred to the author's forthcoming paper entitled "Two Methods for Determining the Most Probable Values and Certain Related Constants."[1]

IV. THE ELIMINATION OF SEVERAL VARIABLES

Suppose we have a problem of seven variables, and the numbers s_{ij} are computed in the order (1, 2, 3, 4, 5, 6, 7). Suppose that we wish to eliminate the variable x_4 first, then x_2 and x_5, and we are interested in the regression equations of x_6 on (x_1, x_3, x_7) and x_7 on (x_1, x_3, x_6). Then we should rearrange the numbers s_{ij} in the order (4, 2, 5, 6, 7, . . .) or (4, 2, 5, 7, 6, . . .), the order of the last two numbers (1, 3) being immaterial. We now apply the elimination method to eliminate x_4, x_2, x_5.

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NOTE ON PROFESSOR KELLEY'S METHOD

IN REVIEWING Professor Kelley's *Essential Traits of Mental Life* in the September issue of this JOURNAL I made the statement that original units were necessary to obviate what I called a trivial solution. I now propose to compare the two solutions, amplifying my comment in the sixth paragraph of the review.

If the original variables are standardized and unit variances are introduced in the diagonals of the matrix of covariances, the latter reduce to correlations. Professor Kelley's method can indeed be applied to such a matrix, but the solution will be inconsistent with that obtained by employing variances and covariances and subsequently standardizing all the variables, unless all original variances are equal. I shall illustrate these points by a two-variable example.

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[1] To be published in the *Journal of Social Sciences*, the Institute of Social Sciences, Academia Sinica, Nanking, China.

Let the original tests be x_1 and x_2 with $\sigma^2_{x_1}=9$, $\sigma^2_{x_2}=4$, and $p_{12}=3$, $r_{12}=.5$. Then $\tan 2\theta=2p_{12}/(v_1-v_2)$; $\theta=25°6'$; $\cos\theta=.906$; and $\sin\theta=.424$. If the factors be denoted by y_1 and y_2 the orthogonal transformation becomes

$$\begin{aligned} y_1&=.906x_1+.424x_2 \\ y_2&=-.424x_1+.906x_2 \end{aligned} \tag{1}$$

From these equations we may next calculate the following constants: $\sigma^2_{y_1}=10.411$, $\sigma^2_{y_2}=2.596$, $\sigma_{y_1}=3.227$, $\sigma_{y_2}=1.611$.

In order to standardize we shall next use the following standard scores:

$$z_1=x_1/\sigma_{x_1}=\tfrac{1}{3}x_1,\ z_2=x_2/\sigma_{x_2}=\tfrac{1}{2}x_2 \tag{2}$$

$$w_1=y_1/\sigma_{y_1}=y_1/3.227,\ w_2=y_2/\sigma_{y_2}=y_2/1.611 \tag{3}$$

Substituting (2) and (3) in equations (1),

$$\begin{aligned} w_1&=.842z_1+.263z_2 \\ w_2&=-.790z_1+1.125z_2 \end{aligned} \tag{4}$$

It will be observed that $\sum w_1w_2=.000$, hence the standardized variables are uncorrelated. This transformation, however, is no longer orthogonal, as noted in the review.

We may also obtain a factor pattern from equations (4) to produce the correlation as a check:

$$\begin{aligned} z_1&=.974w_1-.228w_2 \\ z_2&=.684w_1+.729w_2 \qquad \textstyle\sum z_1z_2=.500 \end{aligned} \tag{5}$$

Let us next standardize the original variables at the outset, denoting the tests as z_1 and z_2. Since $v_1=v_2$, $\theta=45°$ and $\cos\theta=\sin\theta=1/\sqrt{2}$. The factors may then be written

$$\begin{aligned} y_1&=(z_1+z_2)/\sqrt{2} \\ y_2&=(-z_1+z_2)/\sqrt{2} \end{aligned} \tag{6}$$

We again calculate the constants, $\sigma^2_{y_1}=\frac{3}{2}$, $\sigma^2_{y_2}=\frac{1}{2}$, $\sigma_{y_1}=\sqrt{\frac{3}{2}}$, $\sigma_{y_2}=\sqrt{\frac{1}{2}}$ in order to standardize the factors y_1 and y_2. Thus

$$w_1=y_1/\sigma_{y_1}=y_1/\sqrt{\tfrac{3}{2}},\ w_2=y_2/\sigma_{y_2}=y_2/\sqrt{\tfrac{1}{2}}. \tag{7}$$

Substituting (7) in (6) we find

$$\begin{aligned} w_1&=(z_1+z_2)/\sqrt{3} \\ w_2&=(-z_1+z_2) \end{aligned} \tag{8}$$

Again we note that while w_1 and w_2 are uncorrelated, the transformation (8) is no longer orthogonal.

The factor pattern now becomes

$$\begin{aligned} z_1 &= .866w_1 - .500w_2 && && (9) \\ z_2 &= .866w_1 + .500w_2 && \textstyle\sum z_1 z_2 = .500 \text{ (check)} \end{aligned}$$

Now it is apparent that the standardized factors given by equations (4) are quite different from those given by equations (8), and a similar difference may be noted for equations (5) and (9). We have thus arrived at inconsistent solutions when the variables are standardized initially and after analysis by use of variances.

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WEIGHTED AGGREGATES AND INDEX NUMBERS

THE EXPLANATION of price indexes by the so-called "weighted aggregate" method is beset with important misunderstandings which are a natural result of the loose application of the terms "weighted aggregate" and "quantity weights." These difficulties are (1) theoretical, involving problems of definition and interpretation; and (2) practical, involving the mathematical accuracy of the results.

1. Weights, in a weighted average, must be commensurables, if the average is to have any significance. A computation may call for weights expressed in terms of tons, or of dollars, or of kilowatts, but in each case the resulting weighted average should be capable of expression as per ton, per dollar, or per kilowatt. One would expect a parallel in the case of "weighted aggregates."

This requirement with respect to commensurable weights is not fulfilled when index numbers are explained in terms of "weighted aggregates," or "quantity weights." As a result, such critics as Bassett Jones have been misled into declaiming against the whole concept of index numbers on the basis that such indexes can only represent a weighted average price per "horse-apple."[1]

Of course, if the index number concept were explained on the alternative basis of the weighted average of price relatives with weights based upon values, which are commensurables, or upon some other commensurable criteria, then the difficulties evaporate and, along with them, the alleged *reductio ad absurdum.*

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[1] Jones, Bassett, *Horses and Apples*, John Day Company, New York, 1934. In fact, the comment on the jacket of the book (by Dr. Michael A. Heilperin) includes the following statement: "Mr. Jones contends that no 'price level,' either that for 1926 or for any other year, has ever been established and questions whether it is possible to determine such a general price level."

The term "weighted aggregate" deserves reexamination because of this misunderstanding and because of other difficulties. The "sum of the (quantity) weights" is never calculated nor are the weighted totals ever divided by such a sum. Incidentally, it has never been made entirely clear whether the "weighted aggregates" are the individual *pq's* for each commodity or the sums of these *pq's*. A considerable gain would be made if terminology could be made more precise. The frequently accepted term, "aggregative method," overcomes some of the difficulties, particularly if "quantity multiplier" or simply "multiplier" replaces "quantity weights."

2. An examination of a practical index number problem reveals another source of confusion in the misuse of the term "quantity weights." In an index which undertakes to hold weights constant, it is assumed that this is accomplished by holding the quantity multiplier constant, even though it may have been necessary to make a substitution in the price series, replacing the price series for a given article with another series representing a higher grade and, therefore, a higher price for the same article. Naturally, the same "quantity weight" applied to the higher price gives a larger aggregate and hence a larger relative importance for that commodity in the final index. This is true even though the index computation employs the chain method to accomplish the splicing-in of the new price series. Under the weighted-mean-of-relatives method, price splicing would not alter the effective weight of the article in question.

A still further complication of the "weighted aggregate" method of index number computation can be cited. Assume that the relative importance (true weight) of the price observation for a given commodity is to be based upon that commodity's value in exchange. The customary procedure in the weighted aggregate method is to take the quantity exchanged and multiply by the price quotation which is to be used. But the price series may often be based upon a high or a low grade of an article, and the resulting value figure may fall far from the true value in exchange for that commodity. Quotations based on highest grade articles increase the effective weight, while prices based on low grades reduce the effective weights of commodities in the index. Examples have been pointed out in the Bureau of Labor Statistics Wholesale Price Index where the weighted aggregate figure for a given commodity or group (calculated for the year to which the "quantity weights" applied), exceeded by a considerable margin the total reported value of the production of that commodity or industry in the year in question.

The examples given constitute a strong argument for statisticians, faced with practical index number problems, to employ the weighted mean of price relatives method which does not involve the difficulties presented above. The aggregative method could still be used as a convenient short-cut method, *if* used with proper care. It should be remembered that the aggregative formula[2] $\Sigma p_1 q_w / \Sigma p_0 q_w$ is identical with the weighted arithmetic mean of relatives formula[2]

$$\Sigma(p_1/p_0)p_w q_w / \Sigma p_w q_w,$$

only so long as p_0 is identical with p_w.[3] The difficulties cited should put alert statisticians on their guard whenever they say "the weighted mean of relatives, weighted by values, *or its equivalent,* the weighted (?) aggregate index number."

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GEOMETRIC PRESENTATION OF CORRELATION

It is sometimes advisable to present the results of a correlation study (whether it be simple, multiple, or curvilinear) in graphic form so that the relationships may be seen, making explanation and interpretation easier as well as facilitating comparisons with other studies. The following method may be used as a graphic representation of r, R, or ρ.

Since $\sigma_y^2 = \sigma_{y'}^2 + \sigma_z^2$ (where $\sigma_{y'}^2$ is the explained variance and σ_z^2 is the residual variance), we can express the standard deviations as sides of a right triangle using the well known theorem that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides. To further standardize the procedure we can make σ_y in all studies always the same length. This length is made the diameter of a semi-circle within which is inscribed the above right triangle.

Further, r, R, or ρ is equal to $\sigma_{y'}/\sigma_y$ which in the following figures is the cosine of θ. These figures, representing two correlations, were constructed by looking up the correlation values .85 and .97 in the body of a cosine table to obtain the angle θ which was 31° 47′ and 14° 4′ respectively.

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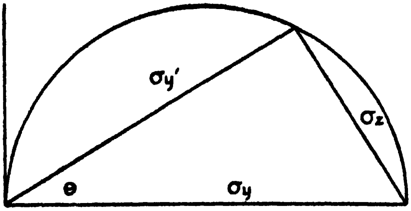
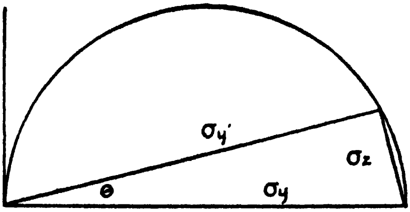
[2] "Weights" designated by subscript w.

[3] In discussing this matter with other statisticians, the writer frequently encountered the comment, "I always assumed that p_0 and p_w woud be the same " The examples given above should be sufficient to indicate that in practical index number work this is not always the case, even when base period weights are used.



$r = .85$



$r = .97$

When $\theta = 0°$, $r = 1$, since the cosine $0° = 1$; and when $\theta = 90°$, $r = 0$, since the cosine of $90° = 0$.

To present the results of a correlation study to those not versed in statistical terms, such as executives, business men, customers or clients, it is possible to remove the Greek letters and label the appropriate sides of the triangle "original," "explained" and "unexplained" and entitle the figure "A Breakdown of the Fluctuations of [*dependent variable*] Considering the Effects of [*independent*(*s*)]." To make the results even more pictorial the $\sigma_{y'}$ line may be drawn heavily in black and the σ_z line in red. It is thus very easy to see without explanation that the smaller the unexplained red line the better the correlation. This geometric method of presentation of correlation can be comprehended by the layman at a single glance.

JOHN W. MORSE

A STATISTICAL PROBLEM IN FORESTRY: ALLOCATION OF LOG YARDING COSTS ACCORDING TO LOG VOLUME*

The California Forest and Range Experiment Station, located at the University of California, Berkeley, is one of twelve regional experiment stations maintained in the major forest regions of the United States by the U. S. Forest Service. It undertakes a very wide range of problems involving statistical aspects which may be of some interest to statisticians outside of its organization. Examples of its problems are: Mathematical solutions of a road system giving the maximum territory covered for specified combined auto and foot travel time limits, and with the minimum expenditure for the roads and for fire protection on an annual and square mile basis; variance and covariance analyses of livestock grazing range inventory, forest genetics progeny tests, and timber cruise data; multiple correlation analysis of spread of fires as related to wind velocity and moisture content of the fuels on the forest floor (consisting mainly of the accumulated needles which fall from the trees); and allocation of log yarding cost according to log sizes.

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* Article suggested and sponsored by C. L. Hill, Chief, Sections of Forest Products and Economics, California Forest and Range Experiment Station.

The last mentioned problem is one of great importance to the lumber industry, to whom this research has been the means of showing that they have lost direct money on the logging and manufacture of trees below certain diameters. "Yarding," as used in this connection, is the lumbering term for the gathering of logs from the places where they lie after the tree is felled and cut into logs, to a central point where they may be bunched for further transportation by truck, railroad, or otherwise, on their way to the sawmill. In the case following, this yarding was done by tractors. The point of particular statistical interest is the method of deriving standard normal equations from expressions of the fundamental relations involved. Part of its interest arises from the fact that the process of minimizing, by which it is accomplished, is omitted or ignored by so many of the statistical textbooks.

The problem is to allocate, according to log volume, the time cost for yarding, which consists of taking tractor out to get a load, of hooking logs to tractor, of bringing the load of logs in to the landing and of unhooking the logs at the landing and turning the tractor around so that it is in position to go out for another load. Four time phases are involved: Out time, hook or assembling time, in time, and unhook-and-turn time.

While Dr. R. A. Fisher, the statistical authority of the University of London, was at the University of California giving the Hitchcock Lectures for 1936, on "The Design of Experiments," he suggested for this problem trying multiple correlation analysis, by the method of least squares and making, for the in-and-out time phase, the assumption that the in-and-out time per 100 feet of distance is a function of the number of logs on the load, the log volume, and the square of the log volume.[1] The expression to be minimized then is

$$S[T/L-b_0n-b_1s(v)-b_2s(v)^2]^2$$

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[1] Compare the article, "A suggested method of allocating logging costs to log sizes," by Besse B. Day, *Journal of Forestry*, 35: 1, pp. 69–71 (January, 1937). The application of the method of least squares to these problems of log movement (either yarding or transportation) was first discussed by Dr. Fisher with Miss Day in the summer of 1936. Whether the solution of such problems should rest upon diameters or volumes as the fundamental variable depends upon the nature of the individual problem—in some cases even upon the choice of the investigator. The problems covered by the two present papers, however, seem to be of the former kind. The application of the method in Miss Day's article was specifically limited to railroad transportation of logs, for which she properly chose to use diameter and diameter squared. In railroad transportation all cars travel the same distance; and the limiting factor of load is mainly one of cross-dimensional space occupied by the logs (within limiting restrictions of total load) rather than one of volume as such. This is due, first to the varying length of logs, a short log seldom permitting utilization by other logs of the volume space wasted by its own lack of length; and secondly to the difference of taper in different logs. In tractor yarding, on the other hand.

where S represents the sum; T, the time in minutes to bring logs in; L, the distance; n, the number of logs on load; v, the log volume in M cubic feet; $s(v)$, the sum of the log volumes on the load, in other words, the load volume; $s(v)^2$, the sum of the squares of the log volumes; b_0, b_1, and b_2, the regression coefficients. Minimizing is accomplished by partial differentiation of the above sum of squares of the residuals with respect to the parameters b_0, b_1, b_2, respectively, and equating to zero.

$$\left.\begin{aligned} &S[(n^2)b_0-ns(v)b_1-ns(v^2)b_2-n(T/L)] &&=0\\ &S[ns(v)b_0-s^2(v)b_1-s(v)s(v^2)b_2-s(v)T/L] &&=0\\ &S[ns(v^2)b_0-s(v)s(v^2)b_1-s^2(v^2)b_2-s(v^2)T/L] &&=0 \end{aligned}\right\} \begin{array}{l}\text{Normal}\\ \text{Equations}\end{array}$$

The regression equation is $T/L=b_0n+b_1s(v)+b_2s(v^2)$. Dr. Fisher proposed setting n equal to unity and then finding pairs of values of T/L and v, within the range of values for v, so that a curve might be plotted showing the relationship between cost in minutes per hundred feet of distance and log volume in M cubic feet.

In treating with the other time phases, Dr. Fisher suggested assuming that hook-and-unhook time is a function of the number of logs on the load, the sum of the log volumes and the sum of the squares of the log volumes. Now the expression to be minimized is

$$S[T-b_0n-b_1s(v)-b_2s(v^2)]^2.$$

This least squares method may be adapted to many types of problems where one variable is a function of several other variables. When the parameters are linear, the solution is quite simple.

The total cost of logs delivered to the sawmill, in addition to the yarding and transportation costs includes the direct costs of felling the trees; of clearing out the surrounding underbrush, called "swamping," to facilitate subsequent work upon the tree; of cutting off the limbs, called "limbing;" and of sawing the trunk into logs, called "bucking." Besides these direct costs are of course the general or overhead costs of timber survey and appraisal, road and railroad construction and maintenance, logging camp construction and maintenance, and sundry others. Of the direct costs, however, the yarding is considerably the most complex in the number of factors which enter into it. The varying distances between position of felled logs and their landing destination, which result in a yarding load cost that is not uniform, as it is in

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the solution, as in the present paper, uses volume and volume squared, with the addition of the variable L, the distance traveled. This is because in yarding the distance of travel is variable, and the in-and-out trip time is also a function of the resistance of the logs to tractor pull The traction resistance is a function of the weight of the logs and, since the logs are of different lengths, volume is required as a variable rather than diameter. Dr. Fisher, when he visited Berkeley in October, 1936, approved the above distinction and suggested the use of the volume variable as indicated in the text.

railroad transportation, are worked up in some eight 500-foot class intervals from 0–450 to 3,500–3,950. Each of these distance classes then involves the four time-phases above enumerated, of which the solution in the case of the combined in-and-out time is indicated in detail in this paper. Finally, if different "landings," or log concentration stations, and/or different types of tractors are used in the logging operation studied, the data for each one of these variables may have to be separately classified and evaluated.

The net result of such a logging and sawmill study is, first, a curve of total direct costs, accompanied by a curve showing the additional general or overhead costs per thousand board feet of lumber realized; second, for comparison with the preceding, a curve of total money returns received from the lumber realized. These curves are plotted upon an abscissa of tree or log diameters and an ordinate of money value in dollars. The costs increase sharply toward the origin, i.e., with decreasing size of logs, due to the increasing number of logs which must be handled for a thousand feet of lumber realized, while the money values realized decrease in the same direction because of the decreasing quality of the lumber realized from small logs. The curves of cost and value therefore cross at a point of zero profit which, in the case of pine logs from California forests, is about the 20" to 24" diameter, depending upon the quality of the timber and the efficiency of the logging operation. Below that point the cost and realization curves diverge so sharply that, at a diameter of 12", down to which trees were formerly cut by lumbermen, the direct money loss may be as much as $10.00 per thousand board feet. An entire logging and milling study is thus a very complicated undertaking. One such study conducted by the California Forest and Range Experiment Station involved over 30,000 Hollerith cards.

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WHAT USE IS INDUSTRY MAKING OF RESEARCH AND STATISTICS?*

A particularly rapid advance in the use of research and statistics in industry has occurred since 1920. At the present time, the large companies have come to recognize research as a proper staff effort, particularly as an aid in preventing errors in management decisions and as an aid in planning. All companies, however, do not recognize the research function in the same way in so far as its place in the organization is concerned. In some companies, the research department is given considerable dignity and prestige by reporting to a vice-president. In others, the importance of the research function has not been given comparable recognition. Its place in the organization depends primarily upon the type of business and the capability of the management to direct and use research work. Centralization of the research function has the advantage of giving it a dignity and a standing not otherwise attainable. If the research division reports directly to a vice-president or other officer on a comparable level, it aids in the creation of a realization of the importance of research. Businesses that are large and diversified in nature have to be decentralized in operation. In such businesses, research is a function of sufficient importance to deserve a centralized set up and a dignified status in the organization.

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* A report by Ray D. Kinkaid of the discussion of this subject by Mr. A. T. Kearney, partner of McKinsey Wellington and Company, before the Chicago Chapter of the American Statistical Association on January 26, 1937.

There is, of course, no standard by which one can measure the effectiveness of research as an aid in business problems. In attempting to measure its value, the best assumption is that business is a cooperative effort instead of an individual effort. If the management of a business takes the best steps possible, it is likely to be the result of the pooling of ideas originating both in the research department and in the line organization.

The more rapid progress in the use of statistics and research in recent years has occurred because of a recognition that an activity to be of value must be attuned to the needs of the management of a business and must be accepted thereby if it is to perform a useful function. Research is being accepted as an indispensable function in business organizations because good business management requires more than the unsupported judgments of busy line executives. The acceptance of research as an aid to business managements has been furthered by a definite change in the mental attitude of executives in the last twenty years. Executives are now more open-minded in their attitude toward outside help. Human nature may not change but human attitudes do change. These changes in attitudes include the growth in the spirit of inquiry, the willingness to experiment, and in the desire to delve for truths. Executives who operate entirely on an empirical basis are now less satisfactory. This change in the mental attitude of executives is of primary importance since research can go only as far in fulfilling its functions as the general attitude of the executives permits. Research, of course, can flourish only as an appendage to something else, and not for its own sake alone.

The more open-minded attitude of executives toward research has resulted in large part from the push of circumstances, and the observance by executives of the phenomena of change around them. Executives found themselves faced with problems they didn't know how to handle. Influences both internal and external complicated the problems of management and made it necessary for the busy line executives to get help from somewhere. Of perhaps greatest importance among these influences was the growth in the size of businesses. Previous to the growth of business into large units, the only farflung enterprise was the army. The staff function has been recognized in the army for years. As businesses grew in size, it was only natural that an accompanying growth in the staff functions, including not only research, but also control and personnel, should occur. The staff functions are here to stay as long as business remains as complex in nature as it is today.

There has been a good deal of lost motion in the development of research to the point where it is of service to business. Two reasons might be given for this lost motion. The first reason which might be cited is the attitudes or limits of the executives research is trying to help. It is not a good excuse, however, to say that the people one is associated with are too dumb to learn or unwilling to accept needed research assistance. At the least, such an excuse would be a reflection upon the salesmanship of the person involved. The general tendency has been to overemphasize the importance of knowledge and to underemphasize the mental attitudes involved. It is essential in research work to meet wrong attitudes of mind and to overcome them. The second reason is that we research workers haven't understood as well as we should the problems with which business executives have to deal. We haven't understood what is involved in the job of an executive. Staff men differ from line men in being of a more studious and reflective nature. He fears that if he acts hastily he'll be wrong, while a line executive has to make many decisions quickly. An ideal research worker is one who understands the job of the executive, is able to do research work, and is able to sell the results of research work to the executives. It is essential that staff people have a better comprehension of what the business executive has to do!

The research function can be an aid to the executive largely in connection with the formulation of policies. The whole job of policy making, however, cannot be gotten out of the research department. There are three requisites to policy making, as follows: inspirational thinking, interpretation of experience, and research or analytical thinking. The last involves checking the accuracy of the conclusions reached by the other two types of thinking. Original thinking in the business field is comparatively rare. Original thinking, however, is usually found in the development of large and outstanding businesses. The research worker, however, does not have a monopoly upon original thinking. He can only hope to contribute to policy making.

In understanding the job of the executive, the research worker must recognize that executives must get things done. In filling his job, it is necessary for the executive to understand the validity of facts and correlate them, to evaluate and interpret experience, to direct and coordinate people, and to strike a good balance between time and accuracy. These four points constitute a good definition of the word "executive." It would be a great advantage in selling research work if research workers would try to gain a better and more sympathetic understanding of what the executive expects from him. This involves understanding the whole question of business management. For executive use, reports must be brief. The executive doesn't care about the methods used but is primarily interested in the results. For an executive to be sold on research work, he must have confidence in the research workers. Such confidence develops from the degree with which the research worker's results check with his own independent thinking. The research worker should be a good psychologist, and find out how the executive wants things presented and thus save the time of both.

In answering the fourth question, dealing with the opportunities involved in the further development of the use of research in business, Mr. Kearney said that if he interprets the signs of the times right, there is an increasingly great emphasis in business on the point of view and the contribution the research worker is supposed to bring into business. The need for research workers is going to be great and the opportunities for research workers are going to be great. There is first the opportunity for developing professional prestige in the research and statistical field. Research workers will also have opportunities for promotion to executive positions, and Mr. Kearney expects to see a good many executives drawn from the research field in coming years. Research, particularly in the marketing field, is too young to have permitted the development of executives through that channel but the time, however, will come when executives will be drawn therefrom. The research worker has the advantage of broad contacts in the business, the chance to develop a wide acquaintanceship in the business and a broad knowledge of the problems involved in the business. People get ahead by making people think well of them. Research provides a good opportunity to workers in the field to let people know them. It gets down to the question of individual development. The first requisite in research workers getting ahead is an inquiring mind, the second is an open mind, and the third is his qualities and effectiveness in action. These are the same qualities that are essential in the successful executive.

STATISTICAL DISCUSSIONS AND RECOMMENDATIONS OF THE WORLD TEXTILE CONFERENCE

A World Textile Conference was held in Washington, D. C., in early April, 1937. It was called by the International Labor Organization and was attended by delegates and advisers and two observers representing every important textile producing country in the world with the single exception of Italy.

The Conference was called in order to survey all of the international economic problems of the textile industry. It had before it an elaborate study prepared by the I.L.O. entitled "The World Textile Industry."

While other committees of the Conference were debating the conclusions that might be drawn from the facts presented in the Report, a Statistical Committee considered the adequacy and accuracy of the statistical material contained therein. The delegates considered that the Report had done as much as could have been done in the short period available to fairly present the statistics that had been presented in different countries, but they were dissatisfied with the figures for two reasons. In the first place, it was frequently impossible to make international comparisons of statistics because terminology and classifications in different countries were so varied. In the second place, there were many gaps in the information because neither Governments nor employers had been regularly collecting some of the more significant data. The recommendations of the Statistical Committee were designed to meet both of these deficiencies.

The discussion in this Conference of the 40-hour week in the Textile Industry had to be based on quite inadequate data. For seven years the International Labor Office had been attempting to secure an agreement between countries on the basis of which it could make international comparisons of certain labor data but Governments had been unwilling to cooperate in it. In 1937, however, a new atmosphere was apparent. The statistics discussion was carried on within the framework of an entire and inclusive consideration of the serious derangement of the textile industry and the low labor standard that had resulted. Delegations that were debating the difficulties or possibilities of international agreements towards improved labor conditions in industry were less reluctant than their Governments had previously been to cooperate in the collection of basic statistical information.

The report of the Statistical Committee, accepted by the full Conference, proposed that the I.L.O. circulate a questionnaire to secure certain basic labor data. It calls for the total number of workers in each branch of the industry, and for an adequate sample of each branch, the total number of workers on the pay roll and their total wages, and total normal and actual working hours in one week. All of this data is to be classified by sex, and into three age groupings. From such raw data average hourly rates and weekly earnings and average actual and full time weekly hours are to be computed. The questionnaire also will request data on the character of the mechanical equipment in the industry.

The Committee recommended that such figures make a distinction between factory and outside employees, that to them be added data on the number of workers in two and three shift operations, that the overtime and night rates be compiled and that each national statistical agency compute a frequency distribution of plant average actual hours. It also recommended that a national authority take particular care to make its sample representative both geographically and by size of plant.

The Conference recommended that a survey of this nature should be repeated each few years. In addition to wage and hour information, it considered that the study include reports on the ratio between total pay rolls and value added by manufacturer, upon employment and unemployment in the industry and upon the mechanical equipment of the industry.

In addition to such a periodical survey the Conference favored the collection of more frequent reports upon the total man-hours, total wages and total number of employees of a representative sample of the main branches of the industry.

In considering the economic data presented in the Office Report, the Statistical Committee made a number of recommendations concerning the gaps that are apparent in the national reporting of production, import and export and consumption data. It recommended a classification of such data that would facilitate international comparison. Of fundamental importance in the discussion of the international economic problems of the industry the Committee considered data upon costs of production. It found the most serious gaps in the statistical information available in connection with such costs. It therefore recommended that upon a few typical items clearly specified costs of production be secured from representative firms in different countries. This recommendation was opposed by the representatives of a number of employers but the Committee felt that on the basis of the support given the idea by the Government and employer delegates from the United States, Japan, and Canada that the study might be usefully attempted.

Although the Conference proved to be a useful step forward in several directions in grappling with the problems of the industry it can be said that one of its most important contributions was its discussion of the available statistical materials. From its recommendations in this field should come a much more elaborate and useful series of data upon both labor and economic aspects of the industry. Regardless of the outcome of the 40-hour week Convention for the textile industry that is to be debated at the June Conference of the I.L.O. the statistical work done by the preliminary Conference in Washington is certain to be of enormous importance to the individual countries and for future planning on an international scale for the textile industry.

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APPLICATION OF STATISTICAL METHODS IN THE AMERICAN SOCIETY FOR TESTING MATERIALS

The American Society for Testing Materials recently announced a new printing of its *Manual on Presentation of Data* which includes, in pamphlet form, material of an essentially statistical character that has been prepared for use in the various standing committees of the Society.

The Manual is an outgrowth of activities of the Society's Technical Committee on Interpretation and Presentation of Data which was formed early in 1930 in response to a growing demand for more widespread application of statistical methods to the special problems of the Society. This committee now has a membership of over forty, consisting of regularly designated representatives of standing committees and so-called special adviser-members in the ratio of about four to one.

The principal activities of the Society—the accumulation of knowledge of engineering materials and the standardization of specifications and methods of testing—are peculiarly adapted to the application of statistical methods. The physical or chemical properties of any material, or of any batch of material can only be expressed by the results of testing portions, specimens or samples of the whole. The establishment of specification limits to be met by individual specimens and of acceptance criteria to be met by the test results of samples to be selected from shipments or lots of product, inherently involves questions of variability from specimen to specimen and from lot to lot. In preparing standard specifications for material or product yet to be made, a committee can proceed in a more sure-footed manner if there is available some quantitative information as to how the material will behave under different conditions and how closely the variations in its properties can be controlled at reasonable cost under the normal operating conditions of a well-equipped plant. Analysis and summarization of the data of past experience is commonly an important phase of specification work, particularly since it is the aim of a producer operating under a specification to produce the same thing again and again. The problems of specifying and producing engineering materials and of judging their quality generally deal with "repeated series of like events occurring under generally like conditions," a situation which is especially susceptible to statistical treatment. It is but natural that the method of approach should differ somewhat from that required in treating results for an isolated sample from an isolated "universe."

The main section of the Manual treats the descriptive aspects of statistical methods, discusses frequency distributions and the more commonly-used statistics, such as the arithmetic mean and the standard deviation, and gives a number of short-cut methods of computation. Stress is laid on the importance of using efficient statistics to express that part of the total information contained in a set of observations, which is essential to the intended use of the data. The first Supplement gives a suggested procedure for presenting plus-and-minus limits of uncertainty of an observed average, and discusses the problem of number of places of figures to be retained in presenting results. The second Supplement gives formulas and tables useful in applying the "control chart" method (developed by Shewhart) of analysis and presentation of data obtained from several samples. A number of illustrative examples are given to indicate how the recommended procedures may be carried out in practice.

It has been the policy of the Technical Committee to make available in the form of supplements to the Manual, additional material of a statistical character which the Society considers of general interest to its members.

H. F. DODGE, *Chairman*

Technical Committee on Interpretation
and Presentation of Data, A. S. T. M.

HANDBOOK ON SOURCES OF ECONOMIC DATA PERTAINING TO CALIFORNIA

A Handbook on Sources of Data pertaining to California is being compiled by the Research Department of the California State Chamber of Commerce. This reference manual will give a brief description of the principal fact-finding agencies that compile and/or publish economic data pertaining to California, and will contain a comprehensive index of the information available from these agencies. Primary and secondary sources will be included in the agency section of the Handbook, covering the various federal, state, county, and municipal departments, bureaus, and divisions; universities, colleges, foundations, etc.; and commercial organizations such as trade associations and chambers of commerce, independent companies, banks, advertising agencies, publishers, independent research and statistical organizations, etc.

A wealth of economic information pertaining to California has been and is being collected by public, semi-public, and private agencies embracing nearly every aspect of economic and social life. The mass of facts thus assembled is so great and diversified that it is difficult to know what data are available and what agencies collect or disseminate the desired information.

One of the greatest barriers limiting the use of economic information by business men and organizations is the lack of knowledge as to what facts are available, where they are, and how and where they may be obtained. Also, in nearly every investigation, much time, effort and money is spent by many searchers, and even trained research workers, in locating the proper source of the data needed. This source-book is planned as a guide to agencies compiling and/or publishing economic facts pertaining to California that are generally available to research workers, librarians, business men, instructors, etc.

In the description of the agency will be included: (1) Name and address, (2) date of establishment, (3) addresses of the agency's California offices, departmental units and/or representatives, (4) a brief summary statement of the main objective(s) of the agency, (5) a condensed statement of (a) the nature of economic research work done, being done and to be done, and (b) the kind of economic data collected and/or published by it, (6) agencies working in conjunction with it, and (7) where and how the information may be obtained.

The second part of the Handbook will be an index of the facts and statistics available to research workers from the agencies described. Index references will be by number to the source agencies. The completeness of the index, however, will depend primarily upon the amount of information contributed by each agency solicited.

The method of obtaining the information for the Handbook is by questionnaire, supplemented with suggestions, illustrations, and a letter. The list of agencies receiving the questionnaire was compiled from suggestions secured from over forty persons interested, either directly or indirectly, in economic research. In the office files, a separate folder was made for each agency which contains the correspondence, the information received, and a record of the progress of editing and indexing. In cases where the replies are insufficient or inadequate, further investigation is made either by correspondence or interview. Before mimeographed copies are made of the edited reports of the agencies for inclusion in the Handbook, a typewritten copy is sent to the agency for correction and/or approval.

It will be some time before the final report is released. While all of the agencies on the original list have been sent questions and many replies have been received, new sources are being uncovered to which questionnaires are being sent. Also, the need for further correspondence for additional information is postponing the date of issuance of the final report.

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FEDERAL ACCIDENT STATISTICIANS

A group known as the Federal Accident Statisticians, composed of representatives of those Federal Governmental agencies engaged in accident prevention and reporting, has been organized in Washington. The first meeting was called in September 1935 by Sidney W. Wilcox, chief statistician of the Bureau of Labor Statistics, for the purpose of obtaining the opinion of Government statisticians on technical aspects of the American Standards Association's proposed standard for compiling industrial injury rates. It was decided to organize and hold future meetings for the purpose of discussing matters of mutual interest to the members. Mr. Wilcox was elected chairman, and Swen Kjaer, chief of the Division of Industrial Accident Statistics of the Bureau of Labor Statistics, was named secretary. The members of the program committee are Halbert L. Dunn, chief statistician, Division of Vital Statistics, Census Bureau; W. W. Adams, head of the Employment Statistics Section, Bureau of Mines; and Edward Crane, statistical analyst, Bureau of Statistics, Interstate Commerce Commission. The list of people who have participated in the meetings now numbers over 70, and 27 agencies are represented.

Among the speakers who have addressed the Federal Accident Statisticians are Leonard W. Hatch, chairman of the American Standards Association's sectional committee on standardization of methods of recording and compiling industrial injury rates, who reviewed the development of the proposed standard with particular reference to the rule as to inclusion of temporary disabilities; Max D. Kossoris of the Bureau of Labor Statistics, who spoke on the Bureau's new approach to the analysis of industrial injury rates; and H. W. Heinrich, assistant superintendent of the Engineering Division of the Travelers' Insurance Company, whose subject was the statistical technique required for accident causes. Mr. Heinrich is chairman of the American Standards Association's sub-committee for revision of the cause code.

PROGRESS OF WORK IN THE CENSUS BUREAU

ANOTHER CENSUS OF RELIGIOUS BODIES

The Act of 1902 establishing the permanent Census Bureau names "religious bodies" in the list of subjects on which the Director of the Census is authorized to collect statistics decennially following the completion of each main decennial census; and under that authorization the Bureau has taken three censuses of religious bodies, covering, respectively, the years 1906, 1916, and 1926, and is now taking the fourth covering the year 1936.

The method by which the statistics are being collected is similar to that employed in the preceding censuses. A list of church organizations is obtained from yearbooks or other denominational publications. This is supplemented by correspondence with the central office, if there is one, or with ministers and other officials of the denomination. When the mailing list is completed, a schedule is mailed to the pastor, clerk or other official of every church, with an official envelope for his reply. The census of 1926 covered 212 denominations and 226,718 churches.

The questions on the schedule include the total number of church members by sex, and the number of church members under 13 years of age; also the number and value of church edifices, and debt on the same. Church expenditures are to be shown in greater detail than ever before, being itemized as follows: pastor's salary; other salaries, repairs and improvements; payments on church debt, excluding interest; local relief and charity; all other current expenditures, including interest; home missions; foreign missions; amount sent to general headquarters; other purposes. The numbers of officers, teachers, and pupils in church schools are to be given distinguishing Sunday schools, summer vacation Bible schools, week-day religious schools, and parochial schools. A new question in this census asks for the average church attendance per Sunday.

In the preparation of the schedule the Bureau consulted the American Association of Statisticians of Religious Bodies, the International Council of Religious Education, and many individuals representing large religious denominations.

The schedules are now being sent out, and the returns are coming in. It is expected that the data will be tabulated and the reports published before the end of the year 1938.

COMPLETION OF THE 1935 CENSUS OF BUSINESS

The 1935 Census of Business is now completed. The reports, which were printed by the multilith process, comprise 35 volumes, having a total of about 2,600 pages. There are 6 volumes on retail trade, 8 on wholesale trade, 3 on construction industry, 3 on service establishments, and one each on banks, financial institutions other than banks, insurance, hotels, places of amusement, bus transportation, motor trucking for hire, public warehousing, radio broadcasting, advertising agencies, distribution of manufacturers' sales, retail trade survey, and miscellaneous business. A booklet, "Business Census Publications," giving a brief description of the content of each volume may be obtained on application to the Bureau of the Census. A series of special studies on various phases of retailing and wholesaling will follow the publication of the regular reports.

The basic data tabulated in this census include sales or receipts, operating expenses, number of proprietors and firm members, number of employees, and pay roll. The number of employees was returned by months. The main statistical items, including regularly the number of establishments, total sales or receipts, number of employees and pay roll, are as a rule shown by states and for principal cities; and in case of retail trade and of service establishments they are shown by counties also and for every city or other incorporated place within the county having more than 2,500 inhabitants.

This census, it may be recalled, was financed by funds supplied by the Works Progress Administration; and except for the technical and supervisory force, all the employees for both field and office force were taken from the relief rolls. The office force at the headquarters in Philadelphia, where the returns were received and tabulated and the results printed, reached a maximum of 1,825. The total force employed in the field was about 16,000. The field canvass was started on January 2, 1936, and completed on October 30, 1936.

THE NEW ADVISORY COMMITTEE

The first meeting of the reorganized Census Advisory Committee was held in Washington on April 2 and 3, and was devoted mainly to acquainting the members of the Committee with the organization of the Bureau giving them the opportunity to meet the heads of the various divisions and to learn about their work, functions, and problems. As the organization of this committee represents in some respects a new departure, a brief reference to the history and origin of the antecedent committee may be of interest.

The original Census Advisory Committee was created in 1918 at the request of the Secretary of Commerce, who addressed identical letters to the Presidents of the American Economic Association and the American Statistical Association requesting the appointment of a committee "to be advisory to the Director of the Census and the Department of Commerce in connection with the work of the Fourteenth Census." It may be of interest at this time to recall what the membership of that committee was. It comprised William S. Rossiter, Chairman, Carroll W. Doten, and Edwin F. Gay appointed by the Statistical Association; and Walter F. Willcox, Wesley C. Mitchell, and E. R. A. Seligman appointed by the Economic Association. Later Allyn A. Young was added to the membership.

With the completion of the Fourteenth Census in 1922 the purpose for which this committee was originally appointed had been fulfilled. But at the request of the Director of the Census the committee was reconstituted and made permanent, consisting as before of three members from each of the two associations but with the term of office limited to three years, two members going out each year. This was the basis on which the committee operated up to the end of last year, when it was decided with the approval of the Director and of the executive boards of both Associations to have the entire membership of the committee appointed by the Statistical Association. Accordingly, at the January meeting of the Directors of the American Statistical Association appointments to the new committee were made as follows: Robert E. Chaddock, Chairman, Frederick C. Mills, William F. Ogburn, Murray R. Benedict, J. Frederic Dewhurst, and Paul T. Cherington.

J. A. H.

STATISTICAL NEWS AND NOTES

CENTRAL STATISTICAL BOARD.—The President transmitted to the Congress on March 9, the Second Annual Report of the Central Statistical Board covering eighteen months ending June 30, 1936. (Copies may be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., at ten cents each.)

The Bureau of Agricultural Economics and the Central Statistical Board are cooperating in a study of the problems involved in conducting a sample census of agriculture. Mr. J. J. Morgan, of the Bureau of Agricultural Economics, is directing the study and a committee composed of Mr. Frederick F. Stephan, Chairman, Mr. Charles F. Sarle, Mr. Z. R. Pettet, and Mr. Morris A. Copeland, has been established by the Central Statistical Board, to advise Mr. Morgan.

DOMINION BUREAU OF STATISTICS, CANADA.—*1936 Census of the Prairie Provinces.* Since the last interim report of January 25, 1937, the Census Branch has published a bulletin in connection with the quinquennial census giving the population by geographic divisions of these provinces and also a statement of rural and urban populations by census divisions. The coding and punching of the occupation and agriculture cards are now completed and tabulations are well under way. Final compilations of both population and agriculture are expected to be ready for publication in the near future.

Social Analysis Branch. This division is working on, and has practically completed, a project for the compilation and publication of official life tables for Canada and its various geographical divisions (provinces and zones, etc.). Extension of the work to a series of tables having particular reference to earnings, employment, dependents, etc., is in progress.

Agricultural Branch. This Branch has recently issued a report surveying world trade in wheat for the latest 10 calendar years, 1926 to 1935. The report is divided into two parts: Part I deals with world exports and imports of wheat by individual countries. Charts are included which depict the share each country contributes to the world exports and imports respectively. Part II deals with the chief importing countries, the compilation showing the sources from which such imports are obtained. Tariffs and restrictions in force in each importing country are described. The publication has been prepared primarily for those engaged in the grain trade, but it should prove valuable for reference purposes generally.

Transportation and Public Utilities Branch. With the organization of the Dominion Department of Transport, statistics on air transportation and air harbours, which formerly have been compiled by the Aviation Branch of the Department of Marine, have been transferred to the Dominion Bureau of Statistics and these will be published hereafter by this Bureau. The first report to be issued will cover operations for 1936.

Education Statistics Branch. This branch of the Bureau of Statistics is working in collaboration with the National Film Society, the Canadian Broadcasting Corporation and the National Gallery of Canada, in the study of the use of auditory and visual teaching aids in Canadian schools. A similar survey in the United States was recently made by the Office of Education, Washington.

General Statistics Branch. The seasonal indexes used in the compilation of business statistics have recently been revised to reflect important influences developed in recent years; the index of the physical volume of business and its components, have been recomputed for 1936. The number of factors used in this index is now 46.

DIVISION OF RESEARCH AND STATISTICS, BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM.—Results of a recent survey made by the Board of Governors and the Federal Reserve banks with regard to interest rates charged by member banks were published in the April 1937 issue of the *Federal Reserve Bulletin.* The survey was made as of October 1, 1936, and compares for different groups of banks interest rates they charge to the greatest number of borrowers and on the largest volume of loans of various types, such as commercial and industrial loans, agricultural loans, loans on urban commercial and on urban residential property, and loans on farm real estate.

The Board of Governors has revised the form on which member banks in 101 leading cities report their items of condition each week, effective as of May 12, 1937. Changes in the report are confined to the classification of loans and discounts, so as to include two significant classes of loans not previously shown separately, namely, (1) commercial, industrial, and agricultural loans and (2) loans (other than to brokers and dealers) for the purpose of purchasing or carrying securities, in addition to open-market paper, loans to brokers and dealers in securities, loans on real estate, loans to banks, and loans not otherwise specified.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.—The Bureau's *Survey of Current Business* for May and June carry special articles which should be of interest to readers of the JOURNAL. The May article presents the Bureau's new index of grocery chain store sales, which is discussed in considerable detail, showing the composition of the sample, the per cent coverage in relation to total chain store sales, the adjustments for various seasonal factors, variation in daily sales, the relative amount of business contracted on the different days of the week, etc., and a chart comparing the movement of sales and the retail food prices. The monthly index is being carried forward as a regular feature in the *Survey.* The article in the June issue presents the Bureau's annual estimates of national income, which are broken down by types of payments and by industries. Reprints of both of these articles are available upon request to the Bureau of Foreign and Domestic Commerce.

The *World Economic Review,* published annually in one volume by the

Bureau in 1934 and 1935, will, for the 1936 issue, be released in two parts. The first part, released in June, contains a statistical analysis and discussion of the economic developments and trends in the United States during 1936. Such subjects as prices, manufacturing and mining, electric light and power, agriculture, construction, transportation and communication, domestic trade, foreign trade, employment and pay rolls, and finance are included in separate sections of the volume. Each section was prepared by a specialist in that particular field and a liberal use of charts has been made. Three interesting appendices are attached: Appendix "A" presents a chronology of important economic events in 1936, Appendix "B" digests legislation enacted by the second session of the 74th Congress and presents in summary form the most important laws of an economic character, Appendix "C" presents in tabular form comparative data from 1929–1936 inclusive covering the more significant indicators of economic change. The second part of the *Review*, which will deal with the economic developments and trends abroad, will be published later.

The Finance Division of the Bureau will have available for distribution during the early summer two publications of wide interest, the annual study of the *Balance of International Payments* and a study of *Foreign Investments in the United States*. The former study, which will cover 1936 data, is the fifteenth consecutive report on the *Balance of International Payments of the United States* to be published by the Department of Commerce, and represents primarily a compilation of our international transactions from the standpoint of commerce, banking and foreign exchange. The second of these publications will present a detailed analysis of foreign investments in the United States by types (stocks, bonds, etc.) and will show both the nations and industries represented. Certain historical background taken from early estimates and other sources and brought up to date will be presented, as well as a qualitative analysis of the various types of investments.

The Bureau of Foreign and Domestic Commerce has for some time been devoting considerable attention to construction economics, and is at the present time preparing annual estimates of the dollar valuation of construction in the United States. Particular attention is being given to the development of logical categories of classification according to ownership, use, and the separation of new works and structures from maintenance and repairs. Wherever possible reported outlays will be used and land and mobile equipment will be excluded.

Several articles by Bureau officials which deal with construction have recently appeared. One, *The British Housing Problem* by Dr. N. H. Engle, Assistant Director of the Bureau, and two by Lowell J. Chawner, Chief of the Construction Economics Section, presenting *Basic Factors in the Trend of Construction* and *Economic Factors Related to Residential Building*. Reprints are available upon request.

The annual study of the Foodstuffs Division on confectionary production and distribution was issued in May. This study which covers 1936 data has several new features; principal among these is a table showing the percentage of sales made monthly for each year beginning with 1928 and carried through 1936 for an identical group of manufacturers. Other features include an analysis by types of manufacturing establishments (specialty manufacturers, general line manufacturers, etc.) and the extent to which total production is represented by the manufacturer's particular type of product, raw material prices analyzed to determine their effect on average value of goods manufactured and on future prices, and a breakdown of the retail price at which bar goods are packed for sale.

The Chemical Division's annual review of world chemical developments will be issued shortly. This volume contains data for all countries of any importance in the chemical field, either as producers or consumers, and deals with such topics as production, employment, prices, new products, significant developments, governmental aids, trade restrictions, etc., for about forty-five individual nations.

The Bureau's annual *Retail Credit Study*, which was announced in the last issue of the JOURNAL, is now in the hands of the printer. This study covers 1936 data which are based on a larger sample than the previous annual surveys, and presents 1935 and 1936 data on cash and credit sales by credit granting stores, installments, collections, bad debt losses and other factors of importance by cities for fourteen important kinds of retail trade. Another publication, "Sources of Current Trade Statistics," is a valuable reference guide as to what current statistics are available, where published, and the frequency of issue.

INTERSTATE COMMERCE COMMISSION.—The Bureau of Statistics has under consideration at the present time the revision and improvement of the commodity traffic statistics of the Interstate Commerce Commission. In addition to discussion with representatives of the railway companies as to the practicability of further breakdowns of existing data, the suggestions of various organizations using these statistics will be invited. The American Marketing Association, at the suggestion of the Bureau, has appointed a committee of three members to prepare a report on Interstate Commerce Commission traffic statistics.

As a part of the semi-centennial celebration on April 1 the Commission has released a new publication of some five hundred mimeographed pages entitled "Interstate Commerce Commission Activities, 1887–1937." This historical summary was prepared by the Bureau of Statistics in cooperation with the various other bureaus of the Commission, each of which furnished a memorandum of the growth and development of its individual activities.

FEDERAL TRADE COMMISSION.—A report entitled "Agricultural Income Inquiry, Principal Farm Products," was made to Congress by the Commission early in March. This was pursuant to Public Resolution No. 61, 74th Congress. The principal farm products, selected as the basis for this study, included wheat, cotton, tobacco, livestock (cattle and hogs), and milk. In addition a special study of potatoes was made.

The subjects treated in connection with the various farm products were: comparison of gross income of farmers and of manufacturers and distributors of farm products; farmer's, manufacturer's and distributor's respective shares of the consumer's dollar; extent of concentration and control in the manufacture and distribution of farm products and their manufactures; methods of acquiring control of manufacture and distribution; farmers' cooperatives; market manipulation of grain; cottom markets; growth of capital, earnings and rates of return of processors and distributors; channels of supply and distribution; salaries of corporation officers; and tax avoidance by corporations and by corporation officers in respect to their salaries.

The report has not yet been printed but is available for examination at the Commission's offices. A summary of the report, together with conclusions and recommendations, in mimeographed form may be obtained from the Commission.

By direction of Public Resolution No. 112, 74th Congress, the Commission has extended the Agricultural Inquiry to fresh fruits and vegetables, table and juice grapes. Already an interim report in the matter, together with tentative recommendations for legislation, has under the terms of the resolution been made to Congress. This has been printed. The inquiry is following along the lines of that made on principal farm products and will be completed the last of May.

In the inquiry made by the Commission in response to Public Resolution No. 130, 74th Congress, costs, profits and prices of concerns engaged in the manufacture, distribution and sale of farm machinery are being investigated. Reports have been received from upwards of a thousand dealers and information on the prices of American-made agricultural implements has been received from American consuls at Pernambuco and Rio de Janeiro, Brazil; Calloa and Lima, Peru; Capetown, South Africa; and Havana, Cuba. One branch of the inquiry is devoted to a study of the methods of distribution, including competitive conditions.

BUREAU OF AGRICULTURAL ECONOMICS.—Dr. J. Neyman, reader in statistics at University College, London, and founder of the statistical laboratory at the Central College of Agriculture in Warsaw, delivered a series of lectures April 6–10 under the sponsorship of the Graduate School of the Department of Agriculture. He lectured on certain fundamental notions in the application of probabilities, the selection of statistical tests, and problems of sampling. He also discussed the application of statistical methods to various problems of importance to the Department of Agriculture, and held a series of special conferences with members of the Department. The subjects of these conferences included the simple theory of confidence intervals, correlation analysis of time series, certain problems in plant breeding, randomized and systematic arrangement of field experiments, and practical and theoretical aspects of estimation. It is the plan of Dr. A. F. Woods, Director of the Graduate School, to bring in one or two leading men in the field of statistics each year for similar series of lectures.

The Statistical Committee of the Bureau of Agricultural Economics has continued its examination of the statistical work of the Bureau. Subcommittees have been engaged in a study of the adequacy and reliability of the statistical series regularly compiled by the Bureau. The use and misuse of correlation in the analysis of time series, particularly prices, also continues to be the subject of study in the Bureau.

FARM CREDIT ADMINISTRATION.—About three years ago statisticians were appointed in each of the twelve Farm Credit Administration districts and since that time research in the field of farm credit and related problems has developed rapidly. Each district statistician is directly responsible to the general agent in his district and is thereby able to serve all credit units in problems involving statistical and economic analysis. Although there is rather wide variation in the kinds of work done in the different districts, about one-half of the work has been basic research on farm credit problems, and the remainder has related to current operating problems of the credit units and to reports on the current economic situation in the district.

Research has progressed further in the field of long-term farm mortgage credit than in short-term credit problems. A large amount of statistical information has been compiled and analyzed to show loan history and general experience of the Federal land banks. Studies are now being made of selected small areas to determine the effect of various factors on the success of loans by Federal land banks. However, it is expected that in the future more attention will be given to research in short-term loans to farmers.

The Economics Subdivision of the Farm Credit Administration in Washington, D. C., follows closely the activities of statisticians in the districts in order to give suggestions, exchange ideas between statisticians, and coordinate the type of work done. On the whole, however, a policy has been followed of placing responsibility on each district statistician for decisions relative to the type of work to be followed in the district. This policy makes the statistician an integral part of the district organization.

In addition to coordinating work on the statisticians, the Economics Subdivision is developing a program of fundamental research in farm credit problems. Some projects will be developed in cooperation with district statisticians and others will be carried on independently by professional members of the Washington staff. E. C. Johnson, formerly of the University of Minnesota, was recently appointed Chief Economist in charge of the Economics Subdivision of the Farm Credit Administration.

Research in agricultural credit by other agencies is being encouraged by the Farm Credit Administration. The Economics Subdivision and statisticians in the districts have cooperative projects with five agricultural colleges now in progress and it is expected that more projects will soon be developed involving other colleges.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR.—Owing to the widespread interest in the cooperative movement and the lack of recent statistics showing its extent, a general statistical survey of activities in the United States has been undertaken. This is in continuance of previous surveys of the Bureau, made at irregular intervals over a period of some twenty years, but will be a more comprehensive investigation than has previously been possible. It embraces all types of consumers' societies, as well as housing, insurance, credit, and workers' productive organizations, but will not include farmers' marketing associations except in so far as they handle consumers' goods.

A comprehensive redistribution of the rent sample used in the Bureau's cost-of-living indexes is being planned. The need for reworking this sample arises from the fact that no complete reconsideration of the houses for which rents are collected has been provided for since the houses were originally selected at the time the 1919 cost-of-living survey was made by the Bureau. As houses have fallen into disuse or been torn down the necessary number has been added from among those in the respective communities of a similar type.

The wage work projected at this time includes an investigation of wages and hours in the cotton textile industry which will probably be as of a March 1937 pay roll period and represent a twenty per cent sample of the entire industry. Wage rates of workers in both the union and nonunion branches of the building trades are also being obtained. The finished report will cover the conditions in 105 cities.

In the series of studies of labor requirements in various industries, of which the latest published report deals with lumber production, the labor requirements in brick making, transportation, and production of plumbing and heating equipment will be the next to be measured.

Activities and methods of procedure of government agencies of all kinds are being surveyed to ascertain what work is being done in the interest of labor and the methods and personnel through which the agencies operate. This entails study not only of state departments of labor but of those dealing with related subjects, such as vocational education and rehabilitation, industrial hygiene, and mining. State, federal, and federal-state agencies acting under recent legislation are included.

UNITED STATES EMPLOYMENT SERVICE.—*Series of Comprehensive Analyses of Active Job-Seekers Continued.* The series of comprehensive surveys of the characteristics of all persons actively seeking work with the United States Employment Service, which was begun in 1935, is being carried forward with a detailed analysis of some 6¼ million applicants who were actively seeking work through the public employment offices on April first. These surveys, which are prepared by the Division of Standards and Research, give detailed information concerning the occupational classification, industrial background and year of birth of all active job-seekers, with cross-classifications by sex, color, veteran and relief status. A complete geographical breakdown of all information is provided in units as small as counties.

The results of the first two surveys of this type were recently published under the title *Who Are The Job-Seekers?* This publication, which was released in April, was accompanied by a similarly detailed report of registration and placement activities over a two-year period under the title *Filling Nine Million Jobs*. Each publication includes a narrative account and extensive tables and charts.

DIVISION OF PLACEMENT AND UNEMPLOYMENT INSURANCE, NEW YORK STATE DEPARTMENT OF LABOR.—A current statistical task of the Bureau of Research and Statistics has to do with the organization of local employment offices for the combined functions of placement and unemployment insurance administration. In order to determine the space and personnel required for the expansion of the employment service throughout the State, the Bureau has been engaged in estimating, for specified geographical subdivisions of the State, the 1938 population, the gainfully occupied population by industry groups, the insurable workers by industry groups, and the probable number of users of local office services in 1938.

The Industrial Classification Code originally developed by the Division has, with some revisions, been adapted by the Social Security Board for use in other states having unemployment insurance laws and for the classification of old age benefit records secured from employers. The Bureau of Research and Statistics is now giving attention to objectives and procedure in the subclassification of the major groups of the present code, to serve the analytical needs of placement and unemployment insurance administration and research.

DIVISION OF RESEARCH, STATISTICS AND RECORDS, WORKS PROGRESS ADMINISTRATION.—*Works Program Statistics.* The March 1937 issue of the Report on Progress of the Works Program has been released. This report reviews the operations of the Works Program since its initiation in April 1935. A summary of the efforts to provide security for the unemployed and other groups in need indicates the setting in which the Works Program has operated. Other sections deal with various aspects of the Program: work accomplished, employment provided, projects prosecuted, expenditures, and the nature of the activities of participating agencies. Detailed statistics presented in the appendix supplement the body of the report.

Tabulations of physical accomplishments on WPA projects in each state and the United States from the beginning of the program through September 15, 1936, have been released. The information is limited to certain types of activities and measures work which has been actually completed as of the above date. A revised report form is being developed with the aim of obtaining another inventory of physical accomplishments in the near future.

A general bulletin on trends in WPA employment from the inception of the program through December, 1936, will be issued shortly, and will include for the United States and the individual states data on WPA employment, earnings, man-hours, and average hourly earnings, by months. Data on persons employed will represent the number of different persons employed at any time during the month.

Two bulletins presenting the results of special studies of WPA employment in June, 1936, are in preparation. Entitled, respectively *Age of Persons From Relief Rolls Employed on WPA Projects in June, 1936,* and *Employment and Wages on WPA Projects in June, 1936,* these releases will be composed largely of statistical material, but will also contain brief textual summaries and descriptions of the data.

Plans are in process for a survey of Works Program labor turnover based on existing records maintained in the various field offices of the WPA. The study proposes the collection, tabulation, and analysis of information such as (a) rates of separations and accessions of the Works Program, (b) continuity and duration of employment on the Works Program, and (c) influence of geographic location, age, sex, family composition, and other pertinent factors upon separation and accession rates and upon continuity and duration of Works Program employment. The investigation is intended to reveal the total number of different persons employed during the course of the Works Program in the areas covered by the study, the number of persons and families dependent upon Works Program at one time or another, and the average period of employment provided. It is planned to limit the initial survey to one state and four cities, in order to perfect the details of the survey preparatory to later extension on a national scale.

An analysis of unemployment data is being made to determine methods of estimating the number of *families* with no employed member. Unemployment estimates and census material purport to give the number of persons out of work. Since the unemployed from one-worker and multi-worker families are all included, the current estimates of unemployment give no clue as to the number of families with no employed persons. This latter information is of special significance from the relief standpoint and methods of deriving this information are being investigated.

The Labor Research Section has completed a report based on a field investigation of the skills of brick and stone masons, carpenters, and painters employed on WPA projects in seven cities. The examination of skills was made independently by representatives of the international trade unions concerned and by representatives of the Works Progress Administration. The investigation which was carried on in January, 1937, indicates that in the seven cities covered the workers studied were generally performing their duties in a highly efficient manner; only 9.0 per cent of all the workers having been judged to be definitely inferior in the quality of their work by both examiners and only 7.6 per cent having been so graded by both examiners with respect to the quantity of the work they were capable of doing.

Relief Statistics. A classification of total expenditures of the Emergency Work Relief Program has now been completed for a number of states. This program was conducted as a part of the general relief program by state and local relief administrations with the aid of funds made available by the Federal Emergency Relief Administration. The tabulations cover the entire program which began when the Civil Works Program was terminated and was discontinued shortly after the Federal Works Program was organized in the summer of 1935. The tabulations classify total expenditures by type of project, by object of expenditure and by source of funds. Tabulations are being published for individual states as they are completed. They are based on optional reports submitted by State Emergency Relief Administrations.

Bulletins on *General Relief Statistics* presenting the total number of families, cases and persons and amounts of obligations incurred for states submitting adequate data and estimated totals for the Continental United States have continued to be published monthly. Preliminary data for urban areas on the number of cases and amounts of relief extended have also been published several weeks in advance of the state and national totals. Both publications have been prepared by the staff of the Advisory Committee on the Collection of General Relief Statistics which functions through the cooperation of the Social Security Board.

Advisory Committee on the Collection of General Relief Statistics. The Advisory Committee on the Collection of General Relief Statistics and the joint technical staff which were established on September 30, 1936, by the Works Progress Administration and the Social Security Board, continued through March 30, 1937, with the work of obtaining, compiling and analyzing for publication reports of general relief activities. At the latter date, reports for each state, either on a complete and adequate basis, or covering a substantial part of the case load and obligations incurred for relief extended, were being obtained from relief or welfare departments in all states but Mississippi.

In addition to this work, other activities of general interest of the joint staff, since the first of the year, were the preparation of a report based on a nation-wide survey of the relief aspects of the distribution of surplus commodities and the preparation of a bulletin entitled "Summary of Recent Statistics of Relief in the United States."

The survey of the distribution of surplus commodities is now in preliminary draft and will be published in final form in the near future. The conclusions in this report are drawn from replies to approximately 250 questionnaires sent to state officials connected with the administration of general relief or special types of assistance and the local relief officials in both urban and rural communities. State Directors of Commodity Distribution also submitted replies to the questionnaire. The individuals from whom comment was invited were carefully selected from the standpoint of their familiarity with the relief problem in their respective states or localities.

The "Summary of Recent Statistics of Relief in the United States" was prepared by Thomas B. Rhodes, Secretary of the Advisory Committee, at the request of Walter West, Executive Secretary of the American Association of Social Workers, and was distributed to delegates to the 1937 conference of the Association. This pamphlet reviews the available statistics pertaining to relief operations of the Division of Public Assistance of the Social Security Board, the Works Progress Administration, the Resettlement Administration, and state and local governments. A limited supply of this pamphlet is available at the office of the American Association of Social Workers at 130 East 22nd Street, New York City.

NATIONAL RESEARCH PROJECT, WORKS PROGRESS ADMINISTRATION.—The several studies undertaken by this Project have been briefly described in other numbers of the JOURNAL. In the March issue it was reported that the work of collecting materials was almost completed. At the present time (April 15) tabulation and analysis are well advanced and reports are in preparation.

A general discussion of the problem of "Unemployment and Increasing Productivity" has recently been issued. This report, based on published materials, was prepared as a chapter in a forthcoming publication of the National Resources Committee entitled, *Technological Trends and Their Social Implications.*

Statistical Studies of Changing Productivity. A forthcoming series of reports will deal with labor productivity in a number of industries. These studies are based primarily on published data.

Special Studies of Selected Industries. Analytical work is proceeding on each of the studies of manufacturing industries, extractive industries, agriculture and railroad transportation.

A survey of "Technology and the Mineral Industries" is now being reproduced for distribution. This report also was prepared for the National Resources Committee's symposium and is based in part on data collected under a cooperative arrangement between the Project and the U. S. Bureau of Mines. A report on small scale placer gold mining will soon be ready for release.

The studies in agriculture will present data on changes in production, employment, farm practices, and machinery and equipment utilized by crops and crop areas. Several monographs will be available in the near future.

Surveys of the Effects of Industrial Changes on Labor Markets and on Individual Workers. Tabulation and analytical work are progressing on each of the labor market surveys, and reports are now in preparation. An analysis of employment and unemployment in Philadelphia in the Spring of 1936 will soon be ready for release.

Special tabulations on work and wages at the Amoskeag Manufacturing Company's textile mills during 1927–35 were prepared in cooperation with the Social Security Board for use in connection with the Tripartite Technical Conference of the International Labour Organization in Washington.

DIVISION OF SOCIAL RESEARCH, WORKS PROGRESS ADMINISTRATION.—*Areas of Minor Civil Divisions.* With the cooperation of local agencies in the states, the Rural Section has computed, or checked, the areas of townships and other civil divisions smaller than counties. The data compiled will include, by state, county, and minor civil division, the land area in square miles and acres, the number of acres in farms and percentage of total area, the total population and population density per square mile.

Areas have been computed by planimeter calculations from Bureau of the Census maps of states with minor civil division boundaries. Land in farms and population figures have been taken from the 1930 Census. There will be no general distribution of the results, but a limited number of copies will be available on request for research workers concerned with population problems and related fields.

Study of Youth Applying for Positions and Placed by U.S.E.S. A study of the extent to which the United States Employment Service reaches rural and urban youth is being planned. The general plan involves securing data, from both industrial and rural counties, on active registrants with the Employment Service as of April 1, 1937. Information on placements will be taken for July, 1934, January, 1935, July, 1935, January, 1936, July, 1936, and January, 1937.

Rate of Replacement of Males in the Rural-farm Population. Rates of replacement of males 18–65 years of age in the rural-farm population from 1930 to 1955 have been computed for the United States. Similar data on a state basis are available for the period 1920 to 1935.

The following recent publications of this Division represent the findings of a variety of studies which were completed during the past year: *Chronology of the Federal Emergency Relief Administration*—Research Monograph VI; *The Migratory-Casual Worker*—Research Monograph VII; *Farmers on Relief and Rehabilitation*—Research Monograph VIII; *Survey of the Transient and Homeless Population in 12 Cities, September 1935 and September 1936*—Research Bulletin, TR-12; *Areas of Intense Drought Distress, 1930–1936*—Research Bulletin, Series V, No. 1; *The People of the Drought States*—Research Bulletin, Series V, No. 2; *Relief and Rehabilitation in the Drought Area*—Research Bulletin, Series V, No. 3; *Natural and Economic Factors Affecting Rehabilitation in the Upper South Plains of the Texas Panhandle and the High Plains of Eastern New Mexico*—Research Bulletin, K-10; *The Agricultural Situation in the Intensive Livestock Production Area of Southeastern South Dakota*—Research Bulletin, K-11; *Natural and Economic Factors Affecting Rural Rehabilitation on the South Plains of the Texas Panhandle*—Research Bulletin, K-12; *Natural and Economic Factors Affecting Rural Rehabilitation in Southeastern Wyoming*—Research Bulletin, K-13, and *Current Statistics of Relief in Rural and Town Areas, November-December and for the Year 1936; December 1936–January 1937 and for the Years 1932–1936; January–February 1937 and for the Years 1932–1936.*

The results of other completed surveys are now in press or in manuscript form.

CHILDREN'S BUREAU, U. S. DEPARTMENT OF LABOR.—*Consolidation of Statistical Services of the Children's Bureau.* Consolidation of three statistical services of the Children's Bureau in a Division of Statistical Research has just been effected. The Director of the Division is Robert J. Myers, of Chicago, formerly director of research and chief statistician of the Illinois Emergency Relief Commission and later of the Illinois Works Progress

Administration. Dr. Elizabeth C. Tandy, of the general statistical division of the Children's Bureau, will be Assistant Director of the new Division. The statistical activities consolidated in the new Division of Statistical Research include those of the general statistical division, the social statistics unit, and the statistical unit of the Division of Research in Child Development.

The general statistical work of the Division includes the planning, tabulating, and analyzing of statistical studies undertaken in connection with the programs of other divisions, and the collection and tabulation of current statistical reports from state and local officials in charge of issuance of employment certificates to children and from juvenile courts handling delinquency and dependency cases.

The work of the social statistics unit of the division will be in charge of Miss Frances M. Welch. This unit, which had its origin in 1930, handles reports from agencies in the group of cities cooperating in reports on local public and private social services in twenty-one fields concerned with or relating to child welfare.

The statistical work on child growth and development will be in charge of Dr. Rachel M. Jenss. These studies of a highly scientific character are undertaken in connection with the programs of the Division of Research in Child Development.

Industrial Home Work Under the National Recovery Administration. A report on industrial home work under the National Recovery Administration setting forth the findings of a study undertaken at the request of the NRA has just been published by the Children's Bureau of the U. S. Department of Labor. The field work for this study was carried on jointly by the Women's Bureau and the Industrial Division of the Children's Bureau. The purpose of the study was to make available to the home work committee of the NRA information regarding conditions under which home work was being carried on in industries in which it had not been abolished by the codes.

The report contains a discussion of industrial home work in general; the scope and purpose of the study; attempts at legal regulation; development of home-work provisions of the codes; home-work operations and conditions of work; and possibilities of adjustment of home workers to factory employment. Specific industries in which industrial home work was studied included the knitted-outerwear industry, the lace industry, infants' and children's wear industry, art-needlework industry, fresh-water pearl button industry, doll and doll-accessory industry, tag industry, and leather glove industry.

The conclusions drawn from this study indicate that attempts to regulate industrial home work through State laws have proved ineffective, and that a number of manufacturers who had brought their home workers into the factory in compliance with provisions of the codes stated that the difficulties of adjustment had not been so great as was anticipated and that the advantages of having the worker on the premises were many. Under the NRA great gains were made where the codes prohibited giving out home work, but in industries in which home work was still permitted, even though limited by certain regulations, the ancient evils continued to exist, constituting a menace to the higher labor standards achieved for factory workers. The great majority of the chief home workers included in this study earned less than a living wage. Fifty-five per cent made less than 10 cents an hour; 82 per cent earned less than 20 cents. Only 5 per cent of the workers reporting hourly earnings made as much as the usual code minimum of 35 cents an hour.

Trends in Different Types of Public and Private Relief in Urban Areas, 1929–35. Under the above title the Children's Bureau has published a summary of available data on trends in relief expenditures and cases in the reporting area from the beginning of 1929 through 1935. The nucleus in the Bureau's collection of relief statistics was a monthly reporting project covering various fields of social and health work in a representative group of cities with 50,000 or more population, for which the Bureau assumed responsibility in July 1930 following a period of experimental development by the local community research committee of the University of Chicago in cooperation with the Association of Community Chests and Councils.

In October 1930 the President's Emergency Committee for Employment requested the Children's Bureau to extend its collection of relief reports to include all cities of 50,000 or more population. The Russell Sage Foundation cooperated by making the data on relief expenditures and cases that had been assembled in its project available for the areas not included in the Bureau's project for the registration of social statistics. In 1932 arrangements were made with the Russell Sage Foundation for transferring to the Children's Bureau the responsibility for the collection of monthly relief reports from these cities. From that time the series covered 120 urban areas.

In accordance with the policies formulated by the Children's Bureau's Advisory Committee on Social Statistics and following the recommendations of the various Federal agencies especially concerned with relief statistics, responsibility for the continuation and publication of the monthly relief series for 120 urban areas was transferred to the Social Security Board as of July 1, 1936.

This report was written by Emma A. Winslow, Ph.D., of the Children's Bureau staff who was in charge of the monthly relief statistics until this work was transferred to the Social Security Board. It is a record of the increased needs for relief during the period of the depression and of changes in the methods used in financing and administration. In presenting the trends for the 7-year period special analysis was made of regional variations in the number of cases aided through different types of public and private relief and in the average monthly relief per case. The report contains 143 pages and includes a discussion of trends and tables showing annual and monthly expenditure for different types of relief and numbers of cases receiving aid.

New Studies Undertaken by the Children's Bureau include: (1) A study of adoption records of state departments of public welfare to determine the effectiveness of state programs for safeguarding the interests of children in adoption proceedings. This study is being conducted in ten states which have authorized social investigations of adoption petitions referred by the courts.

(2) A study of children born out of wedlock, to evaluate the results of the Maryland law which prohibits the separation of a child under six months of age from his mother, except under certain conditions. Data will be obtained as to children born out of wedlock during 1935 in Baltimore to discover the extent to which social agencies have cooperated with the mothers, and some follow-up will be made of cases in which there had been no agency contact. Court records will be consulted for information as to the children who have been adopted or whose paternity has been established through court action.

(3) A study of fetal neonatal and maternal deaths in the District of Columbia which is being made in cooperation with the Department of Health, the Committee on Maternal Care of the District Medical Society, and a number of hospitals which have permitted access to their records.

(4) A study of premature infants, in cooperation with the obstetric and pediatric departments of the Johns Hopkins Hospital, covering all premature infants born in that hospital during the period of the study. A follow-up clinic for all these prematurely born infants has been developed. Through this study it is hoped (a) to determine the value of various types of treatment of prematurely born infants, in order to reduce the high mortality rate of these infants; (b) to work out various problems in relation to growth in the fetal and neonatal periods.

WOMEN'S BUREAU, U. S. DEPARTMENT OF LABOR.—"Women's employment in West Virginia," shortly to come from the press as *Women's Bureau Bulletin 150*, analyzes the pay-roll data for more than 14,000 women in factories, stores, laundries and dry cleaners, hotels and restaurants, in West Virginia in the summer of 1936. Besides current figures, pay rolls for 1935 were made available by 75 of the 199 establishments, so that changes after the NRA codes were no longer in effect would appear. In general, week's earnings were higher in 1936, but hourly earnings, because of an increase in working hours, had declined.

Bulletin 151, "Injuries to women in personal service occupations in Ohio," is based on unpublished figures in 1932 and 1933, for both sexes, made available to the Bureau by the Department of Industrial Relations of Ohio. The lines of employment covered are laundries and dry-cleaning plants, hotels, restaurants, beauty and barber shops, and households. The coverage of the last two probably is limited, as the compensation law is compulsory only in the case of employers of three or more persons. Besides the unusual inclusion of household employees, the figures are exceptional in showing the numbers of all injuries instead of only those that involved loss of time. This feature is important in the study of cause and prevention. The data give cause, location, nature, and severity of the injuries, and age, occupation, wages, and number of dependents of the injured.

The Bureau has made a number of surveys to obtain wage data for the use of the Division of Public Contracts administering the Walsh-Healey Act.

OFFICE OF EDUCATION.—*Statistics of State School Systems.* Continuing the work of reorganizing the Statistics of State School Systems for the 1937–38 collection, five regional conferences were held in March and April with the directors of research and statisticians of from seven to twelve state departments of education at Washington, D. C.; Springfield, Illinois; Salt Lake City, Utah; Montgomery, Alabama; and Hartford, Connecticut. Around a table, for four or five days each, these groups discussed definitions and certain desirable blocks of information that should be a part of a national reporting system and considered what data they could supply for 1937–38.

Library Statistics. Mr. William H. Clift, Statistical Assistant, American Library Association, has been loaned to the Office of Education for three months to set up forms for the collection of statistics of public, school, and college libraries as the first project in the new division of library service.

University Research Project. This program has probably been unparalleled in the scope of cooperative endeavor of large universities in educational research. While not a WPA project, it was financed under the Emergency Relief Administration Act of 1935 and set up according to national, state, and district WPA regulations to use persons on relief who were qualified to do research work. The project was under the general direction of the Office of Education with Benjamin W. Frazier, Senior Specialist in Teacher Training of the Division of Higher Education, as the Director.

Sixty universities and comparable institutions located in 32 states, the District of Columbia, and Hawaii, participated actively in the project during most of the year 1936. The complete list of institutions qualifying for work in the project is given in *School Life* for May, 1936.

Twenty-three members of the regular staff of the Office of Education served as study coordinators of 40 studies. Twenty-three of these studies were proposed by the Office of Education and 17 by cooperating universities. The institutions completed from 1 to 14 studies each, making more than 150 reports on studies. Each project was conducted by from 1 to 31 institutions and all the cooperative research was completed early in 1937. In January, 1937, specialists in the Office of Education who served as study coordinators began the task of assembling and coordinating institutional findings, and of preparing consolidated study reports for the printer. Publication plans call for the printing of many of the major study reports in a series of Office of Education bulletins. All manuscripts will have been sent to the United States Government Printing Office by June 30, 1937.

Some of the more popular project studies undertaken are:—Study No. 7. Economic study of college alumni conducted in 31 institutions, covering

75,000 alumni; Study No. 10. Student mortality in institutions of higher education conducted in 25 institutions, covering 15,000 freshmen; Study No. 14. Relation between certain factors in high school education and success in college, conducted by 17 institutions; Study No. 5. Economic status of rural teachers.

NATIONAL RESOURCES COMMITTEE.—*Public Works.* The National Resources Committee's Report "Public Works Planning" was transmitted to Congress by President Roosevelt on February 3, 1937. This Report includes recommendations for planning, programming, timing, and division of costs of public works, as well as a summary report on drainage basin problems and programs. The Report was prepared by two groups under the National Resources Committee, a special research staff, and by the Water Resources Committee, both working in collaboration with the Projects Division of the Public Works Administration.

Water Resources. On April 12, 1937, the full "Drainage Basin Problems and Programs Report" was released. The report covers in further detail the water problems and programs for 118 drainage basins, and includes maps and project lists. It was prepared by the Water Resources Committee of the National Resources Committee.

On April 7, 1937, the National Resources Committee released its Second Report on Water Pollution. The report reviews the progress made in the treatment of wastes during the past three years and contains statistics on sewage treatment. It also makes recommendations regarding legal, administrative and financial aspects of the water pollution problem. The report was prepared by the Special Advisory Committee on Water Pollution of the Water Resources Committee.

Population Study. The Committee on Population Problems of the National Resources Committee has completed its report to be published under the title of *The Problems of a Changing Population*, Government Printing Office (75¢, paper) and *Statistical Supplement* (30¢, paper). The Committee has also prepared a manual on population studies for the use of State Planning Boards.

NATIONAL INDUSTRIAL CONFERENCE BOARD.—In the field of National Income, to which the Board is giving special attention, perhaps the most important of its recent publications is a statement of national income realized by Dr. Robert F. Martin which covers the entire period from 1909 to 1935. It gives not only an estimate of total income but a classification by source of income and by type of income. Mr. John A. Slaughter has made a study of "Income in Bituminous Coal Mining (1929–1936)" and has presented the first results of an investigation of income by states (1929–1935). The latter publication anticipates the issue of a larger volume on "Income by States," which is in the printer's hands. This volume will show not only the total income of each state but a distribution of this income by industrial source and also by type of income.

The Board's studies in the field of Unemployment bore fruit in a study of "Unemployment and Business Recovery" which has attracted wide attention. Under an assumption of unchanged hours of work and a continued increase of output per man-hour, the conclusion was reached that the year 1940 would see a labor shortage.

The Board's monthly studies of changes in the cost of living were recently summarized for the year 1936 in a special publication. A similar study was made of the "Adjustment of Wages According to Changes in the Cost of Living."

The following studies are under way: cost of government in the United States, 1934–36, sales and chain store taxes, dismissal compensation, economic situation of Germany, the labor force in the United States, and further unemployment estimates. For the Chemical Alliance the Board is undertaking an extensive survey of labor conditions in the chemical industry.

THE RESEARCH BUREAU, WELFARE COUNCIL OF NEW YORK CITY.—Preliminary findings of the Welfare Council's Youth Survey are being presented in *Better Times*, the weekly review published by the Welfare Council. The Survey has been conducted with the assistance of the WPA and at the request of welfare organizations dealing in one way or another with the problems of the City's youth. It is unique in that it is the only city-wide census or sample survey conducted in New York City in which information was obtained regarding the religious affiliation of the population, or a segment thereof. The Survey was conducted by visiting each hundredth residential address recorded on a previous complete survey undertaken for a different purpose and interviewing every person within specified ages found living at the selected addresses who could be located and who was able and willing to give the information desired. This procedure insured so far as possible a genuine representation of all social and economic, racial and cultural groups in the sample of 9,041 young men and women between 16 and 24 years of age. The inquiry as to religious affiliation was in terms of the religious community with which the young person felt himself to belong or which he felt best represented his religio-cultural background. In this sense, 49 per cent of the interviewed youth reported themselves as Roman Catholic, 31 per cent Jewish, and 18 per cent as Protestant. Only one half of one per cent disclaimed any connection with any religious group. The entire sample follows closely the color and nationality of the population of like ages in New York City as shown by the 1930 Census.

AMERICAN STANDARDS ASSOCIATION.—The Standards Council has approved a revised "American Standard for Compiling Industrial Injury Rates." The new Standard recognizes temporary partial disabilities as a distinct class and substitutes lost time for disability as a criterion for compiling accident statistics. It is expected that the Standard will be published soon.

Insurance companies, state accident commissions, labor departments, outstanding trade associations and the Federal Government have all cooperated in the development of this Standard. Mr. Leonard W. Hatch of the International Association of Industrial Accident Boards and Commissions, and formerly of the New York State Industrial Board has served as Chairman of the Committee which developed the new Standard.

POPULATION ASSOCIATION OF AMERICA.—The Fourth General Assembly of the International Union for the Scientific Investigation of Population Problems will meet in Paris on July 28th in connection with the International Population Congress, organized by the French National Committee, which takes place on July 29 to August 1. The Population Association of America, through its Research Committee, which is also the American National Committee of the International Union, is sending a number of delegates to attend the Assembly and the Congress. The delegates appointed, together with the papers which they will present at the Congress, are as follows:

O. E. Baker, "Some Agricultural Implications of the Population Prospect in the United States."
Joseph V. DePorte, "Fusion of the Racial Elements of the American People as Observed in the State of New York."
Harold F. Dorn, "The Relative Amount of Ill Health in Rural and Urban Communities."
Louis I. Dublin, "Life Tables for the Native and Foreign-born Population of the United States, Separately for Rural and Urban Areas."
H. P. Fairchild, No paper.
Carter Goodrich, Subject of paper to be announced later.
Norman E. Himes, "Some Universal Principles on Fertility Control in Man."
Clyde V. Kiser, "Differential Marriage Rates According to Social Class of Parents for Families Enumerated in Three American Cities."
C. E. Lively, "The Development of Research in Rural Migration in the United States."
Frank A. Lorimer, "Distribution of Population in Relation to Economic Resources in the United States."
Alfred J. Lotka, "Some Recent Results in Population Analysis."
Frank W. Notestein, "A Demographic Study of 38,256 Rural Families in China, Based on a Field Study of Selected Communities."
Frederick Osborn, "The Application of Measures of Quality."
Raymond Pearl, "Economic Status, Fertility, and Contraception as Observed in the Populations of Large Cities in the United States."
Frederick F. Stephan, No paper.
S. A. Stouffer, No paper.
Warren S. Thompson, "An Experiment in the Registration of Vital Statistics in China."
Leon E. Truesdell, Subject of paper to be announced later.
P. K. Whelpton, No paper.
Robert M. Woodbury, Subject of paper to be announced later.

T. J. Woofter, Jr., "Rural Population Pressure in the United States and Governmental Policies during the Depression."

Adequate representation of American scholars on this occasion has been made possible by a grant of $2,500 from the Milbank Memorial Fund and a grant of equal amount from the Carnegie Corporation of New York, towards the expenses of the delegation.

THE PSYCHOMETRIC SOCIETY.—The mid-western district meeting of the Psychometric Society was held April 3, 1937, at the University of Chicago. The program was devoted to the mathematics of learning, statistics and test theory, and to factor analysis. Dr. N. Rashevsky of the University of Chicago addressed the Society at the dinner meeting on "Physico-Mathematical Methods in Psychology."

The annual meeting of the Psychometric Society will be held at the University of Minnesota, September 1, 2, 3 and 4 in conjunction with the meetings of the American Psychological Association.

The journal, *Psychometrika*, official organ of the Psychometric Society, has completed its initial year, and No. 1 of the second volume is now off the press.

AMERICAN ASSOCIATION OF UNIVERSITY TEACHERS OF INSURANCE.—The *Proceedings* of the 1936 Annual Meeting of the Association held in Chicago December 28, 1936, have been printed and copies are available from the Secretary, Professor Frank G. Dickinson, University of Illinois, Urbana, Illinois, at $1.50 per copy. This is the first appearance of printed proceedings, although mimeographed editions of the annual meeting papers and discussions have been issued for the first three annual meetings.

CHAPTER ACTIVITIES

The Austin Chapter.—Mr. V. C. Childs of the Division of Crop and Livestock Estimates, United States Department of Agriculture, spoke to the Austin Chapter at a meeting on February 25, 1937. He outlined the work of the Division of Crop and Livestock Estimates, explaining the method of obtaining data for the various current releases of the Division and for long range studies being undertaken. Twenty-six members were present.

At a meeting on March 18, 1937, with seventeen members present, the speaker was Mr. G. D. Clark of the United States Department of Agriculture. Mr. Clark, who had just returned from Cuba where he was in charge of a survey of the fruit and vegetable industry of Cuba, gave a report on this survey. The survey was undertaken by the United States Department of Agriculture at the request of the Cuban Government. The principal crop involved was tomatoes, which the Republic of Cuba ships principally to the New York market. For a part of the season the Cuban crop competes with the Florida crop. Mr. Clark stated that the Cuban Government maintained a rigid control over the exports to prevent any "dumping" of the Cuban crop.

The Chicago Chapter.—At a meeting on February 23, attended by 29 members, Mr. Gerald K. Thorne of Wilson and Company spoke upon the "Development and Use of Agricultural Statistics." On March 24, Mr. W. B. Ricketts, Manager of the Market Surveys Division of Booz-Fry-Allen and Hamilton, addressed 53 members and guests on the subject, "Measuring the Effectiveness of Advertising."

The annual meeting of the Chicago Chapter was held April 28. Speakers were Nat C. Murray, Crop Statistician, Clement Curtis and Company, and Edward N. Wentworth, Director of Armour's Livestock Bureau. Mr. Murray's subject was "Agriculture in Argentina" and Mr. Wentworth spoke on the "Development of the International Meat Trade." Membership of the Chapter, at the last meeting of the year 1935–36, totalled 128 as compared with 107 for the prior year.

The Cleveland Chapter.—The fifth meeting for the present season of the Business Statistics Section of the Chapter was held on February 15 at the Mid-Day Club. The speaker was Mr. Howard Whipple Green of the Cleveland Health Council. Mr. Green's address concerned the relief and unemployment situation in Cuyahoga County.

At the sixth meeting, Mr. Russell Weisman, columnist for the Cleveland *Plain Dealer*, discussed the recent statement of Marriner S. Eccles, Chairman of the Board of Governors of the Federal Reserve System, concerning methods to guard against inflation. An interesting question and answer period followed. There were twenty-five members and guests present at both meetings.

THE CONNECTICUT CHAPTER.—The Chapter held a joint annual and business meeting on January 28, 1937, in New Haven. The speaker at this meeting was Professor Kossuth M. Williamson of Wesleyan University and his subject was "Some Aspects of Business Taxation."

The following officers were elected for 1937: President, Dr. John H. Watkins, Assistant Professor of Public Health, Yale University; Vice-President, Mr. Morgan Mooney, State Bureau of Labor, Hartford, Connecticut; Secretary, Mr. Louis M. Nichols; Executive Committee, Mr. Lawrence G. Flick and Mr. Paul Dorweiler.

The Chapter met on Monday, March 8, 1937, at the University Club, Hartford, Connecticut. The subject discussed at this meeting was "Research and Statistical Phases of the State Reorganization Plan" and the speaker was Dr. Benjamin P. Whitaker, Research Director of the Commission.

THE NEW YORK DISTRICT CHAPTER.—On January 26 the Chapter held a dinner at which attendance approximated 500. The general subject was "The Outlook for Security Prices." The speakers were as follows: Mr. James F. Hughes of C. D. Barney and Company, members of the New York Stock Exchange, Mr. C. J. Collins, Chairman of the Board of Investment Counsel, Incorporated, Detroit, Michigan, Mr. A. W. Kimber of White, Weld and Company, members of the New York Stock Exchange, and Mr. H. M. Gartley of H. M. Gartley and Company, Incorporated, New York City.

Mr. Hughes, speaking on "The Outlook for Stock Prices," described it as more uncertain than during 1935 and 1936, although the favorable fundamental background was unchanged. The technical probabilities are not encouraging since during the last 50 years the market has never had three good years in a row. The financial factor is fundamentally bullish, but includes the uncertainty of a possible important curtailment in the rate of bank credit expansion during 1937. There is no certainty that a further increase of five to ten per cent in general business activity would be reflected in substantial advances of the stock market, especially since such an increase would lift business activity beyond the statistical normal level. Governmental action to control credit and speculation can be expected in 1937, yet it is still uncertain whether such action will be effective in holding the market down. A number of measures have been discussed and at least some of them might well have a serious, although temporary, effect on the market.

Mr. Collins pointed out that the 1932 deflation had caused credit to become redundant and had reduced raw material prices in many instances below production costs. The Lausanne settlement of the pressing war debt problem provided the psychological background necessary to start an upward trend. These basic factors may still be described as favorable. The primary trend points upward for several years to come although it can be subjected to disturbing intermediate interruptions. The conditions which promoted credit expansion in 1935 and 1936 may be materially altered by governmental action. Other factors that may produce intermediate declines are labor troubles, rising business costs, possible overexpansion of inventories, increased taxation, renewed foreign exchange uncertainties in Great Britain and Japan, and the record length and extent of the present intermediate advance. Looking ahead to the next decade, the largest economic question which business and the market must face is whether the inflationary forces largely developed by the political conduct of the past several years can be controlled.

Mr. Kimber discussed "The Railroad Outlook for 1937." The statistical record for recent years has led many to believe that rail transportation is a declining industry. In the peak year, 1926, the Class I railroads carried 440,000,000 ton miles of revenue freight, received operating revenues of $6,383,000,000 and reported net income after charges of $809,000,000. In 1932 the tonnage and revenues had been halved. In 1936 the total ton miles were still about 25 per cent and the operating revenues about 37 per cent below 1926. As a result nearly 30 per cent of the Class I mileage is in receivership and about $2,500,000,000 of obligations are in default. This slump was due in part to competition from other transportation agencies. Motor carriers had been the most damaging competitors. However, some of the freight lost to trucks was unprofitable to the railroads and at least 70 per cent of the ton miles of freight consists of bulk commodities, heavy manufactures and other goods which are unlikely to move by truck. Railroad transportation is a mass production, low cost business and seems unlikely to suffer much further from the competition of waterway, pipe lines or truck. Other important reasons for the slump in railroad earnings are the drought in the western states, government crop restriction, and the lagging recovery of the production of capital goods. These factors may be less serious in the future. The elimination of emergency surcharges and the possibility of wage increases are unfavorable factors but a traffic increase of about 10 per cent would offset the losses that may be expected from these sources.

Mr. Gartley pointed out that advances in the price of common stocks comparable to those which occurred during 1935 and 1936 could hardly be expected, but that there was some room for further improvement in share prices. He indicated further that whatever direction these prices take the market will be even more selective than in 1935 and 1936. He pointed out that several developments have operated to reduce the floating supply of shares and to place them in stronger hands. He also pointed out that stock exchange regulation will place a ceiling over extravagant price movements by the employment of some or all of at least ten distinct means available to the Securities Exchange Commission. At the same time he remarked that so far regulation had seemed to produce little change in the character of price movements. Mr. Gartley closed his discussion by pointing out certain minor groups which in his opinion are likely to be outstanding in 1937.

THE PHILADELPHIA CHAPTER.—The Philadelphia Chapter met on March 5, 1937, to discuss "Commodity Prices." Mr. Robert D. Gray of the Industrial

Research Department, University of Pennsylvania, discussed the work of the International Scientific Committee on Price History and the results which have been secured in the study of wholesale prices in Philadelphia from 1720 to 1861.

The International Scientific Committee on Price History was organized in 1929 through the efforts of Professor Edwin F. Gay and Sir William Beveridge. Through funds received from The Rockefeller Foundation, the Committee has coordinated and encouraged studies of prices in England, France, Germany, Austria, Spain, Holland, Poland, and in several areas of the United States: Boston, New York, Philadelphia, Charleston, S. C., New Orleans, and Cincinnati. Twenty-five volumes, in addition to many articles, have already been published or are in manuscript form.

While the primary purpose of the Committee was to increase the amount of factual data relating to previous fluctuations in prices and wages by securing continuous series, it has been interested in applying modern statistical techniques to the analysis of history. How severe, how frequent, and how widespread were the previous fluctuations in prices are some of the questions which the Committee considered. The supplying of continuous series of prices will permit further studies to be made by other students.

Mr. Gray discussed the methods used by the price-study group of the Industrial Research Department of the University of Pennsylvania in collecting wholesale prices reported by the newspapers and in checking the validity of these prices as well as filling in gaps in the newspaper files by using prices quoted in merchants' letters and account books. He also selected three conclusions reached by the Philadelphia group which are of special significance in current studies of fluctuations in prices:

1. Disregarding the Revolutionary War period, there were twenty-five complete cycles in prices from 1731 to 1861. Detailed statistical measurements of the length and severity of these cycles showed that there was no persistent tendency for the movements of prices to become more or less severe or longer or shorter during these years in which Philadelphia was influenced by the beginning of a change from an agricultural to an industrial community.

2 The study in Philadelphia of prices during the century and a quarter preceding the Civil War illustrates the difficulties involved in determining whether or not prices of one group of commodities are out-of-line with prices of another group. Although similar cycles in prices occurred in most series, there was no year in which the price of every commodity was higher or lower than it had been in the previous year. The study also emphasized the fact that agricultural prices have always fluctuated more violently than prices of industrial goods.

3. An examination of the number of times that quotations changed each year showed that so-called "administered prices" have always been characteristic of certain commodities. It was found that the prices of some commodities tended to become more sensitive as facilities for transportation and communication improved. Other commodities changed in price very infre-

quently and even tended to become insensitive. Some of these changes can be attributed to the growing obsolescence of such commodities and the consequent change in their relative economic importance.

Mr. Waldo E. Fisher, Assistant Professor of Industry, Director of the Coal Section, Industrial Research Department, University of Pennsylvania, discussed prices in the bituminous coal industry. The Committee on Prices in the Bituminous Coal Industry is one of five committees appointed by the Conference on Price Research. These committees have been instructed to make exploratory studies in their respective industries and to suggest programs of research. The Bituminous Coal Committee was appointed in September, 1936. The objectives as approved by the Committee are as follows: (1) To state clearly the scope and operating characteristics of the industry which influence price levels and price problems in this industry; (2) to ascertain what price and related data are being currently collected for this industry; (3) to appraise these data and to make recommendations as to how the factual record of the bituminous coal industry may be made more useful to the industry, the government, economists, and the public; (4) to suggest those phases of the problems of prices which are in need of further study and research and which are of greatest significance to the industry, economists, and the public; and (5) to consider the steps which might be taken to promote and more effectively coordinate research in price and related problems in the bituminous coal industry.

The Committee has made a careful survey of the price data being currently collected for this industry. It is also working with the Bureau of Labor Statistics and assisting it in its revision of both the wholesale and retail price series which the Bureau is collecting for the industry. The Committee is now engaged in preparing a coordinated program of research in bituminous coal.

Mr. Stephen J. Kennedy, Director Research of the Pacific Mills, New York City, discussed prices in the textile industries. Effective research into the behavior of textile prices can contribute importantly to the analysis of problems confronting the textile industry. These problems include among others such important phases of textile marketing management as determining the effects of manufacturers' price changes upon consumer demand at various stages of the business cycle, and conversely the effects of retail price brackets upon manufacturers' prices. Before effective work can be done along these lines, however, more progress will need to be made in improving basic textile price data. Important and far-reaching steps pointing in this direction are already being undertaken by the Bureau of Labor Statistics, both in the wholesale and retail fields. All possible encouragement to the continuance and extension of this work should be given by every statistician interested in price analysis.

Investigation in this field will also be greatly aided if account is taken of the interrelationships of textile prices on the various levels of manufacture. The Committee for the Study of Price Research in Textiles, which has been conducting a survey of existing textile price data with a view to making possible further studies in this field, has given a great deal of attention to improving the classification of textile statistical data. This classification which has been worked out is based upon a flow of goods concept from the raw material through the various stages of manufacture to the retail market. Analysis of the behavior of prices in the markets at each stage of manufacture seems to appear to be the most promising line of investigation of textile price behavior. Comprehensive analysis along this line should throw important light upon many problems of interest both to the industry and to economists.

The Chapter met on April 9 to discuss "Statistical Studies of Cost of Living, Dependency and Relief, and Crime and the Depression."

Miss Alice C. Hanson, Assistant Chief, Cost of Living Division, U. S. Bureau of Labor Statistics, spoke on "Family Expenditures of Employed Wage-Earners and Clerical Workers in Philadelphia." Of the 55 cities in which studies of money disbursements of employed wage-earners and lower-salaried clerical workers have been made by the United States Bureau of Labor Statistics since the fall of 1934, five are Pennsylvania cities: Philadelphia, Pittsburgh, Scranton, Johnstown, and Lancaster. Cooperating agencies were the State Emergency Relief Board and the Works Progress Administration. In Philadelphia and Pittsburgh Negro families as well as white families were included.

To take account of the difference in economic level among families resulting not only from differences in family income, but also from the number and character of persons dependent on family funds, the families studied have been classified according to expenditure per consumption unit. The consumption unit is calculated on a composite basis taking account of the varying expenditure for food and clothing by persons of different age and sex. For "other items" than food and clothing each family member is counted as one, regardless of age and sex since members usually share equally in such items as housing, furnishings, etc.

Calculation of coefficients of variations for similar data obtained in New York City indicate that average family expenditures for food, housing, and household operation are most stable, while there is great variation in average family expenditures for such items as medical care, transportation, and recreation.

Mr. Howard B. Myers, Director of the Division of Social Research, Works Progress Administration, spoke on "Studies of Relief and Dependency." He described the large unemployable relief population, and pointed out that most of these persons, though not all, will need aid for the rest of their lives. Mr. Myers then discussed separately three broad categories of employable workers now being assisted by the Works Program—the aged workers, the youth, and those in middle-age. The aged workers have the lowest reemployment rate, and the longest periods of unemployment. Few of them are in the skilled group from which private industry is absorbing workers at the greatest rate. Mr. Myers emphasized the inexperienced youth group, which must obtain work experience to become a useful part of the nation's labor force. The middle-aged workers present no special reemployment problems, he said, as they are the most competent workers and have the highest reemployment rate although a large labor surplus remains in unskilled labor and semi-skilled trades, in which most of these workers fall.

Mr. Myers stressed the need for a carefully planned, integrated, and far-reaching research program in the fields of relief and unemployment. He discussed the topics concerning which future study is badly needed, and expressed his view that a census approach would give little we need to know. In conclusion Mr. Myers posed the alternatives of adjusting our economy to provide adequate subsistence to the bulk of our population, or of taxing a part to support the remainder.

Dr. Thorsten Sellin, Professor of Sociology, University of Pennsylvania, spoke on the relation of crime to the depression. After reviewing the research studies done in this country on this problem and pointing to the lack of agreement in their findings, he discussed at some length the theoretical questions involved in the selection of indexes to criminality, stressing the fact that, generally speaking, investigations which have attempted to arrive at correlations between crime fluctuations and economic fluctuations have failed to examine closely the sensitiveness of the indexes to either.

THE PITTSBURGH CHAPTER.—At the January meeting of the Chapter, papers relating to the forecast for 1937, monopolistic control, housing, and research on stock market movements by the Cowles Commission, presented at the Annual Meeting of the Association in December, were reviewed by Dr. Ralph J. Watkins, Mr. Glenn E. McLaughlin, Mr. Theodore A. Veenstra, and Mr. J. Blair Easter. Mr. Frank M. Kenney reported on the luncheon meeting of the Association Directors and Chapter Representatives.

The meeting on February 20 was attended by twenty-two persons. Mr. Leonard Shapiro, Chief, Income Tax Division, U. S. Internal Revenue Department, spoke on "Your 1936 Income Tax Return."

On March 25 at a meeting attended by twenty persons, Mr. Ralph C. Fletcher, Director, Bureau of Social Research, Federation of Social Agencies of Allegheny County, spoke on "Collection of Social Statistics and Federation Activities."

THE SAN FRANCISCO CHAPTER.—A meeting of the Chapter on February 18, 1937 was addressed by Mr. Bernard Etcheverry of the Division of Analysis and Research of the San Francisco Federal Reserve Bank who discussed "The Measurement of Business Conditions in the Pacific Coast Region."

Mr. Etcheverry pointed out that at least ten composite measures of business activities and many series of a more specific nature were being maintained for the Pacific Coast region. He noted that most of the general business activity indexes were composed principally of electric power production or industrial sales of electric power, freight carloadings and bank debits with widely varying weights in the different indexes. He pointed out that each of these components had serious shortcomings. Electric power production is generally included to reflect changes in industrial output, but only 20 per cent of the energy is used in industry. Industrial sales of electric power may be fairly satisfactory as expressed in terms of deviations from normal or trend, but energy consumption in any one industry is not proportionate to the economic importance of that industry and even within an industry highly electrified plants may not be representative of other establishments. Freight carloadings is a good measure of the movement of goods originating in the region, but it does not include shipments by trucks and water-carriers. This deficiency was especially serious during the maritime strike. As a measure of output, carloadings are probably quite unsatisfactory since many goods, such as canned fruits and vegetables, are not marketed for a number of months after they are produced and since carloadings measure the bulk rather than the value of commodities moved by rail. Bank debits are affected by changes in the price level and by transactions which do not represent productive activity, such as corporate refinancing activity and security trading.

The problem of constructing a representative industrial output index is difficult because changes in the output of the most important industries for which current data are available, such as lumber or petroleum refining, are not characteristic of changes of output in other industries, such as canning, for which only annual output data are available. Similarly, the considerable amount of data available on construction is not adequate for the creation of a fully satisfactory construction index. Statistics of employment and distribution likewise reveal an inadequate representation of certain important lines of activity. Mr. Etcheverry indicated that in spite of these deficiencies many of the indexes are of very considerable significance.

THE WASHINGTON STATISTICAL SOCIETY.—The Chapter has held four meetings thus far in 1937. The first meeting, on "Measuring Unemployment," was reported in the last issue of the JOURNAL. It aroused so much interest that on February 17, 1937, a discussion group meeting was held at George Washington University to consider the subject of the application of the sampling methods to social and economic data with special reference to unemployment. Ewan Clague presided. Two hundred and ten persons were present. Since this was a continuation of the previous meeting, no formal papers were presented. Numerous short discussions covering sampling and problems of measuring unemployment filled the entire two hours. The discussion was resumed on April 28.

Another meeting was held at George Washington University on March 12, 1937. The subject was "The Statistical Principles Involved in the Construction and Use of Standard Classifications and Nomenclature." The presiding officer was Dr. Selwyn Collins, U. S. Public Health Service. Ninety persons attended. The discussion was opened by Dr. Sidney W. Wilcox, Bureau of Labor Statistics, who discussed principles of classification as illustrated by the Heinrich Code for the classification of industrial accident statistics. Coding principles used in the occupational code of the Bureau of the Census were discussed by Dr. A. M. Edwards. Dr. Edwards discussed the main problems of the Census Bureau in classifying occupations so that the same designation will be understood in all parts of the country and in all of the various industries which must be considered.

Dr. Carroll Palmer of the United States Public Health Service presented a paper on coding principles involved in the standard classified nomenclature of disease. He outlined the different methods of classification which could be used, such as classifying according to the symptoms of the disease or classifying according to the parts of the body affected, and then explained the somewhat elaborate classification adopted as a standard. He emphasized the fact that the present nomenclature is designed primarily for use by the specialist and that no general terms are given. Thus it is difficult for a disease to be classified properly by the general practitioner unless a specialist has been called in. Dr. Palmer felt that the present nomenclature is entirely too detailed so that inaccuracy is apt to result from the inability of the physician to diagnose the particular sub-classification of the disease which could be known only to the specialist. Classification principles as illustrated by the International List of Causes of Death were discussed by Dr. Halbert L. Dunn, Chief Statistician, Division of Vital Statistics, Bureau of the Census. Dr. Dunn explained the present list of causes of death as one which must necessarily include every cause which appeared currently on death certificates received by the Bureau of the Census. This list must necessarily contain general items as well as specific items since all physicians are not able to diagnose causes of death accurately. Also the problems of joint causes when more than one disease, injury or other cause is present were important. Dr. Dunn sketched the changing trends in reported causes of death and suggested that a considerable amount of the change was due to better medical training and the ability to recognize a specific disease which could not be diagnosed as such by the ordinary physician of a generation ago.

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REVIEWS

Abstracts of Papers Presented at the Research Conference on Economics and Statistics, held by the Cowles Commission for Research in Economics, at Colorado College, July 6 to August 8, 1936. Colorado Springs, Colorado. Colorado College Publication, General Series No. 208. Study Series No. 21. 119 pp.[1]

This publication affords a condensed record of the proceedings of the Second Annual Research Conference held under the auspices of the Cowles Commission. There are included abstracts of 36 "lectures." Of these, two are devoted to presenting the results of quantitative research in economics. The remaining 34 may be classed broadly under two heads: Statistical Theory and Technique (16 lectures); and Economic Theory and Description (18 lectures).

The abstracts are long enough, in most instances, to give the impression of summarizing well the content of the lectures. Several of them, running from 1,200 to 3,000 words each, deserve to be classed as well-condensed independent papers rather than as mere abstracts. The abstracts on topics in Statistical Theory and Technique run mostly to a length of 800–1,200 words, and those on Economic Theory and Description, mostly to 1,200–2,000 words. In the list given below, asterisks have been added to designate the several abstracts that may stand as well-condensed independent papers and also numerous others that for many readers may serve well in lieu of more detailed discussions already published or yet to be published by the same authors. The judgments thus expressed doubtless reflect in large degree personal reactions of the reviewer and may invite dissent, especially from the contributors; but it is hoped that they may prove useful as a rough guide for potential users of his admirable collection of abstracts.

As published, the abstracts appear in the order in which the lectures were given, except that the four public lectures included in the group are given separate place at the end. The index is by name of the lecturer. In listing the topics here an attempt has been made to achieve a more or less logical arrangement within each of the three broad categories among which I have apportioned them. Topics in quotation marks are titles under which the abstracts are published. I have taken the liberty of adding to the titles of a few of the abstracts, or of substituting for them other statements for the sake of indicating more specifically the nature of the subject matter.

Economic Theory and Description

"Income in Theory and Income Taxation in Practice" (4 lectures).* Irving Fisher.

"Instability in Competition Between Two Sellers," a further development of Cournot's problem of duopoly.* Tord Palander.

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[1] A limited number of copies is available from the Cowles Commission without charge.

* More complete and self-sufficient than the usual abstract.

"Remarks on the Theory of Foreign Trade." D. I. Vinogradoff.

"Pseudo-Scientific Economic Doctrine." (2 lectures). Joseph Mayer.

Internal stresses as a cause of changes in the general price level.* E. J. Working.

"Monetary Factors in Trade Cycles, Price Disturbances, and Depressions."* Carl Snyder.

"The Depression, Its Causes and Cures."* Irving Fisher.

"The Accumulation of the Precious Metals in India and China."* Dickson H. Leavens.

"Some Economic Effects of Wage Regulation on Interstate Trade."* C. F. Roos.

"The Capital Supply and National Well Being."* Carl Snyder.

"The Ancient Lineage of Capitalism."* Carl Snyder.

"Whence the Fabulous Wealth and Income of the United States."* Carl Snyder.

"Problems of the International Distribution of Population and Raw Materials."* Corrado Gini.

"Population Analysis." A. J. Lotka.

Statistical Theory and Technique

"The Significance of Regression Coefficients." R. A. Fisher.

"Tests of Signicance in Harmonic Analysis." R. A. Fisher.

"Inverse Probability." R. A. Fisher.

"Significance of Analysis of Variance of Time Series," illustrated by data on stock prices.* H. T. Davis.

"Significance Tests for Periodogram Analysis With Application to Prices of Common Stocks." H. T. Davis.

A comparison of the utility of the partial correlation coefficient and three alternative measures of degree of partial correlation.* E. J. Working.

"A General Invariant Criterion of Fit for Lines, Planes, and Functions Expandable in Series, When All Variates Are Subject to Error." C. F. Roos.

"Methods of Eliminating the Influence of Several Groups of Factors." Corrado Gini.

"On the Measure of Concentration with Special Reference to Income and Wealth."* Corrado Gini.

"Some Observations on the Choice of Function in Curve-Fitting," illustrated by the determination of parameters for an exponential function derived from theory and the fitting of a skew catenary, $r = A + Be^{n} + Ce^{-n}$, empirically determined as the best-fitting function.* C. C. Grove.

Relations of lags and forms of cycles in correlated cyclical series to the arrangement of dots in the scatter diagram and the form of the regression function.* Herbert E. Jones.

"Some Elementary Means and Their Properties."* E. L. Dodd.

"The Chief Characteristic of Statistical Means."* E. L. Dodd.

"The Definition and Consistency of Index Numbers." T. H. Rawles.
"Opportunities for the Use of Statistical Method in Industrial Research."* Anson Hayes.
"Use of Laws of Chance in Industrial Development."* W. A. Shewhart.

Quantitative Analyses of Economic Phenomena

"Evidence of Structure [through time] in Common Stock Prices."* Alfred Cowles 3rd.
"The Effects of Short Selling on Stock Prices."* H. P. Hartkemeier.

HOLBROOK WORKING
Stanford University

Exchange Depreciation, by S. E. Harris, Cambridge, Massachusetts: Harvard University Press. 1936. xxix, 516 pp. $5.00.

Professor Harris' book is monumental, not only in its encyclopaedic survey of statistical data relevant to his theme but also in the exhaustiveness and astuteness with which the facts are analyzed and marshalled into ordered arguments. At times the intricacy of the discussion threatens to overwhelm the reader, even one not altogether unsophisticated in the field; and some of Harris' sentences are quite breath-taking. Sustained concentration and the rereading of passages, however, will be amply rewarded.

It is impossible to give more than a faint suggestion of the scope and the positions maintained in this volume; furthermore, the author repeatedly summarizes his findings, in terminal paragraphs, concluding section chapters, and in an introductory chapter on "Some Major Issues." The remainder of Part I, "Mainly Theoretical," considers the a priori probabilities as to whether and how far devaluation will be matched by rising domestic prices or by declining prices abroad; and it presents a statistical summary of the actual adjustments following 1931. The chief determining factors are elasticities of supply and demand at home and abroad, relative importance of traded commodities to domestic supply and demand and to the foreign counterpoints, the possibility of offsetting increased foreign sales with other balance-of-payments items, the possibilities of monopolistic discrimination, the number of countries already off gold, etc. Actually price adjustments have not in general exceeded 50 per cent; but the resulting export bounty is subject to a number of reductions.

Part II gives an amazingly exhaustive statistical analysis of World Trade, Prices, and Production through the depreciation years. It is not surprising that paper countries have extended their trade; nor that imports into the United Kingdom increased most from countries with a greater decline in exchange rates. But in the case of exports from the United Kingdom, the increase was greatest to countries with greater depreciation, explicable only by the fact that income increases in the latter outweighed the unfavorable trade terms. In general prices rose most in those countries with the greatest currency depreciation. One of Harris' most important findings is that, so far as concerns volume of production, "exchange depreciation seems to help more by improving the price-cost structure at home, thus contributing towards a more satisfactory business situation, than by capturing foreign trade at the expense of rivals" (p. 179).

The longest Part in the book (III), devoted to the American devaluation, affords the most lively reading. Professor Harris meticulously analyzes the price- and cost-raising tendencies of N.R.A., A.A.A., public works program, and our money and credit policies before ascribing primary importance to exchange depreciation (p. 480). Quite aside from the position maintained, this section is a treasure-trove of information concerning the economic consequences of Administration policies. The paradoxical increase of our imports, the operation of gold purchases, the divergent character of wheat and cotton price-reactions—these, amongst many involved phenomena, Harris treats with a sure hand.

The book concludes with British devaluation, a Part bound to be less novel because of the substantial literature on the subject, but no less excellent. The export bounty Harris believes to be real but less important than other factors determining volume and direction of trade. Hall errs in his adverse criticisms of the Equalization Fund; in 1933 the pound had to drop to prevent hoarding and in 1934 it had to remain low to prevent England's being compelled to supply us with the gold purchased to depress the dollar.

So far as concerns those elements in the international currency situation which are amenable to quantitative statement, Harris' judgment as to the favorable outcome of exchange depreciation seems to be well-founded. But are there not other important factors? Though devaluation helped to raise prices and stimulate economic activity in the devaluing countries, central banks and business communities in other countries suffered intensely under uncertainty concerning their national currencies. In retrospect, the answer might be immediate devaluation paralleling the English action; but after all this is "hindsight" wisdom. Meanwhile uncertainty about what would happen to the franc, the dollar, and even the pound prevented incisive action and helped to perpetuate the economically disastrous "official" parities and exchange control. Furthermore, resort to devaluation was, in the opinion of most central bankers in Middle Europe, precluded for them by an "inflation psychology" holding over from postwar times. Could they be expected to take this perilous step when the future values of Western European currencies could not even approximately be predicted?

There are still other "institutional" factors in the matter of devaluation. Granting that it helped to check the pointless deflation of the 1931–33 period, did it not give hostages to the future by undermining the public's very unreasonable, but from the viewpoint of monetary stability and control, very useful faith in gold? Finally, although Harris discovers a greater gain in the easing of money rates and the expansion of credit following devaluation than in the improved terms of trade, he seems to *attribute* the former to devaluation. For England this is doubtless legitimate; but for the United States and for the gold bloc countries until 1933, it is not clear how devaluation was necessary to credit expansion.

Despite these misgivings the reviewer expects Harris' *opus* to remain the authoritative treatise upon exchange depreciations following 1931.

HOWARD S. ELLIS

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The Reserve Banks and the Money Market, by W. Randolph Burgess, with introduction by George L. Harrison and Benjamin Strong. Revised Edition. New York: Harper and Brothers Publishers. 1936. xxv, 342 pp. $3.00.

In the ten years that have elapsed since the appearance of the first edition of Dr. Burgess' work, far-reaching and disquieting changes have occurred in America's financial organization. Illusions previously cherished have vanished before the realities of the depression. The faith, once so strong, that the Federal reserve banks were a panacea for all economic ills has been dispelled. The conviction, if not the fanatic belief, that the Federal reserve banks could prevent currency panics, mitigate the amplitude of cyclical fluctuations, prevent millions of unemployed from tramping the streets in vain search for work, was demonstrated to be without foundation. Dr. Burgess recognizes the impotence of the Federal reserve system under certain given conditions and emphasizes the point that no central bank can long endure except on the basis of sound banking, economic, and fiscal systems.

What are the more important financial developments which have occurred since the appearance of the first volume? Listing these somewhat in the order of their appearance:

1. The stock exchange panic and the collapse in brokers' loan totals.
2. The bill market débâcle which carried with it general recognition of the fact that a large quantity of the acceptances outstanding in 1929 were from the outset finance bills. These had been drawn largely to meet the working and fixed capital needs of German business, as was brought out in the course of the German bank inquiry of 1933.
3. The increasing virulence of the bank failure epidemic, which had been in progress since the close of the World War and which culminated in the banking holiday.
4. The gold drain of the fall of 1931, when the United States lost more gold than any other nation ever lost in a comparable period of time.
5. The currency panic of the spring of 1933.
6. Unsuccessful attempts to promote recovery on the part of the Federal reserve banks by the purchase of vast quantities of Government securities.
7. The devaluation of the dollar and the assumption by the Treasury of of the control of the money market.

8. The increase of the excess reserves of member banks to alarming totals through gold imports, purchases of domestic gold, through the silver buying program, and through a small use of the profits of gold devaluation.
9. In consequence of the above. the reduction of money market rates of interest to the lowest levels on record.
10. The substitution of bank credit for savings and consumers' income, evidenced by a rapid growth in the holdings of the public debt by commercial banks and by the increase in installment credit.

It is not necessary, in discussing the second edition of this work, to reconsider the excellent treatment of money market organization and technique, inasmuch as all students of the subject are familiar with Dr. Burgess' contribution in this field. In his fundamental theoretical analysis, Dr. Burgess still adheres to what might be termed the shiftability theory of banking. Doubt is thrown on the efficacy of eligibility standards. Evolving quite logically from these premises is the emphasis given to quantitative considerations in the control of credit. At the time of writing he saw no reason to apply credit brakes inasmuch as the volume of credit wiped out by the depression had not yet been restored (p. 303).

In consequence of a vast amount of theoretical work in recent years, increasing emphasis is being placed on *qualitative* norms. It is recognized among a growing number of economists that quantitative control by way of "reflation" of the credit volume involves qualitative deterioration. Thus the artificial stimulus to an increased credit volume (bank deposits) in the United States over the past few years has involved a substitution of bank credit for savings and consumers' income. The interest rate is no longer permitted to exercise its full regulatory function. Productive energies are not being apportioned to the production of consumers' goods and durable goods in the most useful fashion. Consumers' thrift is not being encouraged. Bank profits have become a function of long-term interest rate fluctuations. In consequence of the lowering of qualitative standards, it is all too likely that the present cyclical swing will be greatly amplified.

The proper application of quantitative and qualitative measures of control is admittedly a most difficult problem and one which awaits a full theoretical solution. Doubtless the solution will come about through bridging the gap in theory between bank deposits (quantitative control) and bank assets (qualitative control).

Dr. Burgess doubts whether qualitative control can be successfully applied. His analysis is a mechanistic one, and, in accordance with this point of view, the reserve banks and member banks have little control over the final disposition of credit.

The handicaps thrown in the way of the Federal reserve banks, in view of the monetary preconceptions of the Treasury, in exercising any type of control is recognized in the study. Dr. Burgess rightly maintains that the reserve banks must be free to sell their Government securities, despite the unfavorable effect of this on the public finances and suggests that the Treasury coordinate its policy with that of the reserve banks.

The interrelations of qualitative and quantitative considerations in credit control are evidenced by the present situation. From the point of view of qualitative considerations, brakes on credit expansion should be applied immediately. To do this, quantitative means must be invoked. A fully developed program would involve the sale of enough securities by the Federal reserve banks to absorb the balance of excess reserves. The profits of gold devaluation should be kept impounded. The silver enactments should be repealed. The interest rate should be permitted to rise and to perform its full regulatory function. This quantitative approach finds its justification in the fact that qualitative standards cannot be applied as long as there are excess reserves. Excess bank reserves have always led to a perversion of banking functions. The reviewer is not optimistic enough to think that any such program will be adopted. The groups that desire the continuance of credit expansion and the maintenance of low money rates are too strongly intrenched to permit effective action to be taken immediately.

BENJAMIN HAGGOTT BECKHART
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America's Experience as a Creditor Nation, by John T. Madden, Marcus Nadler, and Harry C. Sauvain. New York: Prentice-Hall, Inc. 1937. xvi, 333 pp. $3.50.

It is probable that the subject in the field of international economic relations most neglected by contemporary literature has been that relating to the foreign investments of the United States. As a consequence, loose talk and fuzzy thinking have often usurped the position of fact and logic. This new book analyzing America's experience as a creditor nation will serve admirably in clearing the air, first of all because of the factual material here presented for the first time concerning the foreign lending of the United States, and secondly because of the careful analysis of these data.

The Department of Commerce has calculated the long-term investments of the United States at the end of 1930 at about fifteen billions of dollars, nominal value, about half of which consisted of direct investments and the other half portfolio investments. The authors of this book, aware of the immense practical difficulties and the uselessness of an attempt to calculate the actual value of our direct investments abroad, have been content to accept the Department of Commerce's book and nominal values of such investments and to draw, with discount, no more than modest conclusions therefrom. Their analysis concerns almost wholly portfolio investments. Here again they simplify their problem, and again with justification, by stating that the "greater part" (in fact it appears to be about 90 per cent) of our portfolio investments consist of foreign dollar bonds issued in the United States, and by confining their analysis to these foreign dollar bonds.

In the twelve-year period 1920 to 1931, inclusive, according to the Department of Commerce there were publicly offered for sale in the United States foreign capital issues to a value of $11,623,000,000. Of this amount $1,754,000,000 consisted of refunding issues, the net nominal capital being $9,869,000,000. The authors object to this figure because it includes bonds of United States possessions, stocks of foreign corporations representative of ownership, securities of American corporations to the extent that the proceeds of the sale of such securities were used by the issuers for investment abroad, and foreign currency bonds, stating that it exaggerates the extent to which the American public actually loaned its money abroad through the medium of foreign dollar bonds. Their own calculations, excluding the foregoing types, disclose a total of $9,364,000,000 of foreign dollar bonds floated during the period, inclusive of refunding bonds.

Of all the foreign dollar bonds that have been issued since 1920, extensive research on the part of the authors discloses that bonds of a nominal value of $7,490,000,000 were outstanding at the end of the year 1935. (Of this amount, not more than $4,130,000,000 nominal value, were estimated to be held in the United States on that date, and the actual value of these bonds held in the United States at the end of 1935 must have been less than $3,000,000,000; however, in their various computations concerning defaults and the rate of return, the authors employ the figure representing the total amount of bonds issued in the United States and outstanding at the end of 1935.) On 61.5 per cent of the foreign dollar bonds outstanding at the end of 1935, debt service has been paid in full; about 37.5 per cent of the bonds are in default as to interest and about 1 per cent are in default as to sinking fund or principal only. Of the bonds in default, payments on about one-third continue to be made in cash (foreign currency), scrip, or funding bonds. By comparison with depression defaults on groups of outstanding domestic bonds, the authors conclude that investors as a whole in foreign dollar bonds have fared relatively well. Defaults were largely concentrated in Latin American and certain European countries, notably Germany.

The authors proceed with various interesting studies concerning the financial results of American foreign lending. For example, they find that the total payments made to bondholders in cash on account of principal and interest in the years 1920–1935, plus the market value of the securities outstanding at the end of 1935, were considerably greater, even considering defaults, than the amounts paid for them in the first instance; indeed, by an elaborate accounting, they calculate that the average of the annual rate of return on all foreign dollar bonds in the period 1920–1935 was about 6 per cent. This figure again takes into account all defaulted bonds.

In a chapter on the effects of capital exports upon various phases of economic activity in the United States, the authors reach the conclusion that the economic effects of foreign loans on the United States have been considerably less important than is generally believed; that in so far as our our foreign loans stimulated our export trade the effect on commerce and industry was favorable; but that the export of capital failed on the whole to bring lasting benefits to the United States because throughout the post-war period this country followed a policy of restricting imports when its position as a creditor nation demanded precisely the opposite course. Defaults were caused primarily not by the uneconomic nature of the investments themselves but by the inability of the debtors to transfer local funds into the currency of the United States, and the transfer problem has been largely the result of uneconomic restrictions on the free flow of trade.

The book possesses other chapters of general economic and historical interest which make it a well-rounded and readable study of the foreign investment policy of the United States.

In view of the general worth of the book, minor faults can perhaps be overlooked. There is one, however, which deserves mention. That is the failure of the authors to bring out with sufficient clearness and at the beginning of their analysis the relation of foreign dollar bonds to the total of our portfolio investments; also the relation of their computed figures to those published by the Department of Commerce is not in many cases as clear as it might be.

JOSEPH M. JONES

Washington, D. C.

The Problem of Investment, by F. I. Shaffner. New York: John Wiley & Sons, Inc. 1936. viii, 357 pp. $3.00.

Most predepression books on investment oversimplified the problem and underestimated the risk faced by the investor. The postdepression tendency has been to cull, from the none too encouraging record of the past six years, materials for what are, in effect, investors' chambers of horrors.

Dr. Shaffner's book is free of criticism on these counts. He has, indeed, exploded some of the time-worn myths of investing and has dealt realistically and convincingly with many of the pitfalls and detours in the road to successful investing under the complex and uncertain conditions prevailing today. As a basis for his discussion he has presented an appraisal of those investment risks which have their origin in rapid economic change, in the tendency to divorce corporate control from corporate ownership, in the existence of dual interest among the investment institutions serving the investor, in the deterioration of certain legal safeguards for the rights of the security holder, and in the business cycle.

But Dr. Shaffner has not been content to emphasize the importance of risk in investing without exploring the avenues of escape from these risks and appraising the various means by which the position of the investor may be protected by his own and society's efforts. Among the many possible measures for protecting the investor which are considered by Dr. Shaffner are the following: The establishment of uniform accounting methods and standardized corporate procedure, the "concentration of voting power in the hands of voting trustees" to represent the interests of security holders, the development of institutions to "consolidate the interests of scattered investors," representation of minority stockholding groups on directing boards, the regulation of holding companies, Federal incorporation of business enterprises, resort to the doctrine of trusteeship in corporate management, blue-sky legislation, and the regulation of stock exchanges.

The conclusion to which Dr. Shaffner comes is not encouraging. He appears to consider it unlikely that the "rules of the game" will be changed to eliminate the major risks of investing, and he seems to be convinced that the investment problem is so complicated and the risks are so great that the investor cannot, by the exercise of reasonable care, assure the avoidance of those risks. The author concludes that "no layman should attempt to handle his investment unaided, any more than he would try to diagnose his own disease if he were ill"; but his enthusiasm for the investment expert is tempered with caution, for he states that "even with the aid of experts, however, the investor must make some study of the subject himself in order (1) to pick out the best advisers in the first place and (2) to appraise from time to time the quality of the advice he is getting."

Many of the problems upon which Dr. Shaffner has touched might well be the subjects of more extensive treatment than he has accorded them in his book. Nevertheless, he has rendered a distinct service in bringing these questions to the foreground of current discussion and in assembling much of the data necessary for their further consideration.

MURRAY SHIELDS

Irving Trust Company
New York

The Undistributed Profits Tax, by Alfred G. Buehler. New York: McGraw-Hill Book Co., Inc. 1937. ix, 281 pp. $2.75.

The Federal tax on undistributed profits, incorporated in the *Revenue Act of 1936*, has provided the field of corporate taxation and finance with the most heated controversial issue for a good many years. It was passed as an Administration measure in the face of almost solid opposition on the part of business interests. Unfortunately, as is so often the case, the opposition has not hesitated to mix unreasoned and unsound argument, convincing to the uninformed, with logical and sound objection to the end that popular support might be enlisted. Professor Buehler has performed a valuable service in giving the ordinary citizen an opportunity to judge this tax measure in the light of reason, shorn of hysterical and unjust criticism.

It is not necessary to proceed far into this study to discern that the author is not in favor of the undistributed profits tax. In fact, the main criticism that the reviewer would raise is that it develops into an almost too perfect logical condemnation of the tax. Professor Buehler fairly presents both sides of each question as it is raised, states his own position, and modestly admits that his conclusions are tentative and may have to be revised in the light of more information and experience. Nevertheless, he invariably finds that the tax is unsound on every count except that of expediency. Even if one grants that the tax in its present form falls far short of perfection or that it may be a monstrosity, the evidence is not conclusive that some merit may not attach to the taxation of undistributed profits.

Professor Buehler sets out "to describe the features of the new tax law, to state some of the economic and fiscal problems of the Undistributed Profits Tax, and to appraise it tentatively as a member of the federal tax system" (p. vii). First he presents the immediate background of the tax followed by statements of certain proponents of a tax on undistributed profits, notably those of Professor Tugwell. He traces its progress from the President's proposal of March 3, 1936, and the deliberations of both houses of Congress to the final compromise measure of the conference committee which was finally passed and signed late in June. There follows a very full statement of the tax provisions and a brief mention of somewhat similar taxes in other countries. Chapter IV on the extent of corporate undistributed profits of recent years, drawn from a number of recent statistical studies, results in the following conclusions: first, that there was no marked tendency for corporate saving to increase in the period from the World War to 1930; second, the data fail to reveal that an increasing percentage of profits was being saved during this period; third, that it must remain a matter of opinion as to whether corporations saved too much; and, finally, that if corporate saving was honeycombed with abuses, it seems likely that noncorporate saving might have been accompanied by somewhat similar abuses (p. 83). The statistics presented in this chapter are those taken from *America's Capacity to Consume*, from Treasury estimates in *Senate Hearings*, 1936, and from a Department of Commerce publication, *National Income in the United States, 1919–1935*. In addition, reference is made to certain estimates of W. I. King, W. A. Paton, R. R. Doane and others. There are a number of reasons why these studies probably minimize the extent of corporate saving. In the first place, these estimates are based on reports prepared by all corporations for Federal income tax purposes. There is no necessary reason why such income reported for tax purposes may not be considerably less than the income reported to the stockholders. Secondly, most studies purporting to show the amount of corporate saving are in reality showing the net increase or decrease in corporate capital. The reviewer is convinced that the amount of corporate saving is much greater than that shown in these estimates. On the other hand, it is quite possible that additional information would not offer sufficient evidence to change the above conclusions.

The rest of the chapters consider "economic and fiscal" aspects of the tax. Professor Buehler finds it curious that an administration professing sympathy for the small corporation has sponsored tax measures that are "kind to existing monopolies" (p. 104). Large companies with previously accumulated surpluses are not only fortunate in that the tax applies only to future savings but are aided by the effect of the tax in retarding the growth of small competitors, largely dependent upon this source of new capital. He finds also that large companies probably need to save a smaller proportion of profits, thus avoiding the higher brackets of the progressive tax, and that these companies can tap sources of new capital not open to their smaller rivals.

Some of the sponsors of the tax have hoped that corporate dividends will permanently increase as a result of the tax. Professor Buehler is not so sure that this will be the case. After allowing for the pressure of progressive rates in forcing dividend disbursements and the various cases where corporations will prefer this method of avoiding the tax, he cites no less than ten powerful counter tendencies. The marked increase in dividend payments following the adoption of the tax measure is discounted as an index of the future, largely because of the newness of the tax. The author is not convinced that other corporate reforms will automatically follow the taxation of undistributed profits. His position is rather clearly presented when he states, "One wonders if a more constructive attitude on the part of certain critics might not go farther in preserving the corporation as an institution of vast business and social benefit than the destructive tactics displayed recently in the discussion of the undistributed profits tax" (p. 142).

One of the best chapters of the book deals with the subject of taxation and economic stabilization. Professor Buehler first discusses the wide variance of opinion as to the nature and causes of business cycles showing that the various "oversaving" theories, upon which the undistributed profits tax as a reform measure is based, fall far short of unanimous acceptance by economists. It is the author's opinion "that the available evidence does not justify the adoption of an undistributed profits tax . . . as a measure intended to advance prosperity and economic stabilization" (p. 175). In fact, he inclines to the view that such a tax may have the opposite effect, causing instability and involving grave social risks.

Despite the fact that the use of taxation for regulatory purposes is by no means new, the author finds that this particular tax is unwise as a regulatory measure for a number of reasons. First, although the objective of those who seek economic stabilization by means of this tax is commendable, he finds that it is primarily a revenue measure and does little to assist toward better control over economic conditions. Second, the desirability of retarding large and preserving small corporations is highly controversial, but, even if accepted as desirable, he feels that this tax would be the wrong means of producing this object. Third, on the matter of increasing stockholder control of corporate affairs, particularly dividend policy, he feels that this tax would entail more social loss than gain. Finally, he questions both the desirability and effectiveness of this means of attempting to bring about a more equitable distribution of wealth and income.

Not even as a revenue measure does Professor Buehler find the tax desirable. Following an examination of the measure in accordance with the "traditional principles of business taxation" (cost of service, special privileges, silent partner, ability to pay, remedy of inequality), he concludes that the ruling principle here involved is that of expediency, arising out of revenue needs and political circumstances. The complexity of the tax and the administrative difficulties entailed are stressed in pointing out further fiscal weaknesses of the tax. Inconvenience and uncertainty harass the corporations, and various methods of avoidance, some nine of which are discussed, likewise produce uncertainty for the Government. Appraising the tax from the angle of Federal revenue, the author maintains that it will produce an uncertain revenue, is extremely complicated, introduces new complexities into the system, may be held unconstitutional, and may influence payment of dividends contrary to state laws.

Following a short discourse on the "system" (if such it may be called) of Federal corporation taxes, in which the whole program of graduated rates for corporations is brought in question, the author summarizes briefly the strongest array of arguments against the undistributed profits tax that has so far been made available to students of the subject. For those who agree that the case for the taxation of undistributed profits is hopeless, this is a very excellent handbook. The reviewer is not so firmly convinced as the author that a tax on such profits may not be a necessary complement to the present "system" of corporate taxes. The present law was hastily prepared and suffers from the admixture of reform, regulatory, fiscal, and political considerations that prompted its passage. It has aroused such a storm of opposition that its future seems unpromising. Nevertheless, some such tax, provided it does not discriminate against the corporate form of business, is a promising means for eliminating at least some of the inequities of Federal income taxes. In fairness to Professor Buehler, he has not overlooked the possibility of a satisfactory tax on undistributed profits, which he says, "should be employed as a revenue measure . . . " (p. 270). The reviewer feels, however, that Professor Buehler could have increased the value of his book greatly by a discussion at greater length of the ways and means of providing an equitable tax on the undistributed profits of corporations.

J. ELLWOOD AMOS

University of Pittsburgh

Ernteschwankungen und wirtschaftliche Wechsellagen 1874–1913, von Georg Brandau. Jena, Germany: Verlag von Gustav Fischer. 1936. Beiträge zur Erforschung der wirtschaftlichen Wechsellagen Aufschwung, Krise, Stockung. Herausgegeben von Arthur Spiethoff. 107 pp. Rmk. 4.50.

It is of particular interest for the writer to review this short but rich-in-content study as he had opportunity seven years ago to analyze the same problem in relation to American cycles. Arriving at certain conclusions concerning the relationship between agricultural and business cycles in America, the writer suggested at that time that it would be advisable to continue the study on a world scale. Mr. Brandau undertook this task, following lines similar to those used in the writer's study and extending his analysis to twelve countries, six of which are European and six on other continents, about equally divided into industrial and agricultural countries. As can be seen from the title of his study, Mr. Brandau limited his analysis to the forty prewar years. It seems reasonable that he eliminated the war and the postwar period from his analysis, as the war and the postwar inflations affected various countries in such different ways that it is practically impossible to treat them together.

Mr. Brandau constructed for each of the twelve countries the following indices: (a) crop production, (b) crop prices, (c) total value of crops, (d) industrial prices, and (e) purchasing power of crop products in terms of industrial products. For most of the countries these indices are based on five to eight principal crops, characteristic of the respective countries. Among these crops the cereals figure for practically every country, but there are also such crops as cotton, flax, sugar beet and cane, coffee, tea, vines, etc. From these indices for separate countries he builds world indices representing the weighted averages of deviations of indices for separate countries from their respective trends, determined in the form of moving averages.

Analyzing indices of crop production and of crop prices for twelve countries, Mr. Brandau revealed the existence of cyclical fluctuations in these indices, the typical duration of which is very close to that of the business cycles established by Professor W. C. Mitchell from his study of the business annals in 17 countries. The frequency distribution of crop cycles by their duration, based on 104 observations, is surprisingly similar to that of Mitchell's for the business cycles, showing a modal duration for the crop cycle of three years and the next to modal duration of four years. Because of the concentration of high and low points in the indices for separate countries around certain years, the world index of crop production, as well as the world index of crop prices, combined from the indices for separate countries, also reveals well-pronounced cycles, although of somewhat longer duration.

Mr. Brandau was rather disappointed by the fact that he could not discover close relationships between the cycles in agricultural indices and the business cycles by individual countries, at least as close as those which were established by the present writer for the United States or by Professor S. A. Pervushin for Russia. But it was natural to expect this result, as most of the other countries depend more on the situation of the world market of agricultural products than on their domestic agriculture, which is usually not important enough to affect substantially the world situation. However, comparing the world index of crop production (constructed as explained above) with the business fluctuations, he could discover a relationship: that business revivals usually occurred in the years (or around the years) of large world crops, and that recessions followed the small world crops. He noted that this relationship was closer during the earlier period of falling prices (from the 1870's to the middle of the 1890's) than in the later period of rising prices. This last observation was made earlier by Professor Pervushin and was confirmed by the results of this writer's study of American cycles.

Establishing that the business cycles in large industrial countries are in fairly close relationship with the rythmical fluctuations of *world* crops, Mr. Brandau could not find such definite relationships between the business cycles and the total value of world crops or the purchasing power of agricultural products. In his opinion, it must be explained by the fact that these last depend on prices of agricultural products which are not direct functions of the natural agricultural rhythm but depend on many factors changing in time. He found that for the early period (1874–1896) there was a fairly close negative correlation between his world index of crop prices and the world index of crop production, while during the later period no such correlation existed.

In the reviewer's opinion it would be desirable to build the world index of crop prices in a different way from that followed by Mr. Brandau. His world index of crop prices is an average of the indices of crop prices for individual countries, after elimination of their trends. He recognizes that such an index does not represent at all the movement of prices in the world market. In order to have a world index of crop prices more representative of prices on world markets, it would be better to take prices of several important agricultural commodities on the leading world markets and to construct an index based on them. This index could be compared with the world index of crop production constructed for the same leading world crops. Such a method would permit one to proceed further in the analysis of the importance of individual crops, such as wheat, or cotton, or sugar, in the business fluctuations. This would complement Mr. Brandau's analysis by countries.

Presenting a great deal of interesting factual data, Mr. Brandau does not go very far in their theoretical analysis. He points to multiple connections between the agricultural fluctuations and business cycles which are changing with time or even from one cycle to another, and for this reason he cautions against explanation of these relationships on the basis of any one rigid theory. This pluralistic point of view of the author may be regarded as correct.

The writer has several differences with the author in the interpretation of some of the facts, but it is impossible to go into these discussions because of the lack of space. The value of the study is in the presentation of rich factual data and their careful interpretation. Appendix tables on 38 pages supply for each of the twelve countries data used in the computation of the indices and the charts illustrating these indices. These facilitate further independent analysis of data by the reader.

By this publication the author has substantially contributed to a better understanding of the complex relationship between agricultural and industrial cycles, which subject during the recent depression began to attract greater attention than ever before. The reviewer recommends, Mr. Brandau's study to all interested in this problem.

V. P. TIMOSHENKO

Stanford University

Agricultural Prices, by Frederick L. Thomsen. New York. McGraw-Hill Book Company, Inc. 1936. x, 471 pp. $4.00.

As far back as 1920 many of the spokesmen for agriculture out in the states had already formed the habit of telling the professors of economics in the agricultural colleges that their vaunted law of supply and demand was no longer true. What they meant to say had as much truth in it as most sweeping generalizations in economics. The difficulty was in their manner of saying it. They meant to declare that the assumption of free competition upon which economists were then wont to base their analysis of price determination was no longer in keeping with the facts of economic life. But many teachers of economics insisted upon taking them literally and rising to the defense of the law of supply and demand. Professor Thomsen grew up as a teacher of economics in the College of Agriculture at the University of Missouri and no doubt felt called upon frequently to explain to agricultural leaders the heresy of their views. At least he seems to have developed a course in "agricultural prices," and a textbook to accompany it, which are almost wholly in terms of the assumption of a largely free working of the forces of supply and demand. Four pages are the most that can be found in any one place devoted to competition, and these mostly declare its efficacy and almost all-sufficiency as an explanation of price movements. The price theory presented is wholly in terms of the supply and demand curves of free-competition economics—not a word of the theory of imperfect competition. No doubt most of the teachers of courses in "prices" in agricultural colleges still find themselves sometimes confronted by the same heresies as was Professor Thomsen and will find this textbook falling in with present conceptions of their needs. But the day is nigh when this will no longer be so, and it is to be hoped that the author will find an opportunity presently to broaden his treatment in a new edition.

Another outstanding feature of this textbook is its reliance in undue measure, in the reviewer's judgment, upon the procedures of "graphic multiple correlation" as means of isolating the demand and supply curves of economic theory. The chapter on the technique of graphic correlation analysis is the best brief presentation of it now available; but in only one paragraph is mention made of the frequently overmastering difficulty of intercorrelation between independent variables; and not a word is said about non-additive relationships.

Of course it may be said that these are complications beyond the reach of the undergraduates for which this textbook must mainly have been planned.

But for that matter so is this whole chapter on graphic correlation. This serves as an example of a considerable unevenness of the level of treatment of the various subjects covered in the book. Otherwise, the selection of material to be presented is commendable for the purpose in hand. The early chapters present a simple undergraduate theory of equilibrium price. Then follows two chapters on artificial price-raising measures, six not so simple mostly on methods of price analysis, and seven on prices of groups of farm commodities. These last chapters bring together in brief form the results of most of the extant analyses of prices of individual farm products

JOHN D. BLACK

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Volkswirtschaftliche Theorie der öffentlichen Investitionen, by Hans Richter-Altschäffer. München und Leipzig, Germany: Verlag von Duncker & Humblot. Eine Untersuchung über die theoretische Stellung der öffentlichen Investitionen in der Dynamik der modernen Verkehrswirtschaft. 1936. iv, 155 pp. R.M. 5.80.

This is a deductive justification of the policy of business stabilization by public works, touching only incidentally on fiscal questions and methods of administration.

The book is up to date in the emphasis it places upon anticipations in determining the investments of entrepreneurs—whose functions are distinguished sharply, as by Schumpeter, from those of routine business men. Examining in some detail the elements influencing these entrepreneurial decisions, the author concludes that such corrective reactions as are set up by depression (principally lowered costs) may be offset indefinitely by the reactions hostile to equilibrium (working principally through breakdown of confidence and credit). He emphasizes his belief that there is no automatic process turning depression into revival. The depression, like the boom, is cumulative and contrary to equilibrium; but whereas the boom is limited by the scarcity of production factors, the depression is limited only by the extinction of capitalistic production. This is not a new point of view; but the author gives it a clear and persuasive exposition.

As is pointed out in a "Digression on Business Cycle Theory," such a view is incompatible with the concept of a "cycle" as a succession of stages each of which evolves into the next. It would seem more akin to the early idea of catastrophic "crises," except that here the catastrophe begins as a boom which evolves into the crisis and finally the depression, which lasts until some lucky combination of events gives rise to another boom.

Since depressions do not cure themselves, the author views stabilization as a peculiarly public function. Public investment should be judged, accordingly, by its conjunctural effects on private production and employment, not by its profitability in the narrow sense. The objective is pump-priming rather than revenue.

The author enumerates in some detail the components of saving and investment, so defined that when saving is equal to (the price of new) investment, the returns to producers of currently consumed goods are just equal to costs, including a sufficient profit to justify the continuance of production on the same scale. It is not made quite clear, however, whether the equality of saving and investment is to be considered a sufficient or merely a necessary condition of stability.

When wages and prices are pursuing divergent trends, we are told that neither should be allowed to fall. In periods of increasing efficiency, the author favors stabilizing prices and letting wages rise; in periods of decreasing efficiency, he would stabilize wages and let prices rise.

Little that is new is found in the refutations of the orthodox arguments against public works. Nor has the author anything definite to offer as criteria of the business situation. He quotes with approval a list of indicators, such as prices, employment, idle capacity, inventories, and interest rates, but does not specify how these are to be combined. Nor does he suggest the compilation of any new measures of saving or investment.

There are few figures in the book, aside from some interesting data on dwelling construction and public works in various countries and some estimates of investment in Germany. Worthy of note is the convenient summary (pp. 129–138) of the development of the idea and policy of public works, and the useful bibliography. In the elaborate analysis of the components of saving and investment which occupies more than half the book, the statistically inclined economist will find many empty economic boxes and much stimulation to set about filling them.

EDGAR M. HOOVER, JR.

University of Michigan

Business Cycles and Forecasting, by Elmer C. Bratt. Chicago: Business Publications, Inc. 1937. xiii, 501 pp. $3.50.

Although economists generally deny the possibility of overproduction, there has clearly been a surplus output of textbooks in most lines of economics and business. Business-cycle analysis does not share this embarrassment. On the contrary, the subject has lacked a general textbook appropriate for an introductory course.

Professor Bratt's book is more general than the title suggests, owing to a liberal assignment of space to the broad question of economic change. The cylical focus of the subject matter, however, is kept continually in the foreground. The result is a textbook well suited to the needs of students who are embarking on the study of business cycles. Although there are almost 500 pages of text, the treatment does not and cannot go deeply enough to meet all the requirements of advanced courses and retain the scope and balance required of an introductory offering. It may, however, serve reasonably well in advanced work as a coordinator for selected readings. References and study questions at the end of each chapter are helpful for this purpose.

An adequate treatment of business cycles must be partly theoretical, partly statistical. This book succeeds in getting a balanced mixture of both elements. The material is well planned, and the method of presentation is direct. Topical groupings are as follows: (1) nature and measurement of seasonal variation and of long-time trend, (2) statistical methods for measuring and analyzing the business cycle, (3) factors responsible for cyclical fluctuations in business, (4) theories of business cycles, (5) business-cycle history, including a lengthy discussion of the depression of the 1930's, (6) schemes proposed for artificial control of cyclical movements, (7) stabilization of business, (8) business barometers, (9) characteristic fluctuations of the business cycle, and (10) problems and methods of business forecasting. Two chapters are devoted to the "great" depression. There are 40 charts, most of them reproductions from other publications. Heterogeneity in the charts is avoided by careful selection and reproduction. This generous representation of charts from other published sources, however, has the disadvantage of including many time series in which data for recent dates are not shown. Redrafting of these charts, in part at least, to include up-to-date material would have been an appreciable improvement.

In the main, *Business Cycles and Forecasting* is not an essay in a particular business-cycle doctrine. It leans heavily on the side of skepticism of ability to do anything constructive to control business cycles. Professor Bratt's point of view is best summarized in the statement (p. 319): "the cycle is a natural concomitant of the elastic recurrence of human functioning. It allows trial and error, and at the same time permits us to avoid the cumulative effect of errors." Depressions are safety valves, preventing eventual explosions.

The only remedy given a hearty reception is facilitation of decline during the recession phase of the cycle. Professor Bratt prefers to take price subsidence and bankruptcy in one gulp. "Prolongation of depression by artificial intervention" is considered to be "the most prolific cause" of failures during depression.

Suppose that there is a relationship between failures and artificial prolongation of recession. Is the solution of the problem adequate? Is it rational to concentrate on hastening the patient through the disease after he has contracted it, without doing anything of consequence to prevent further contagion? Perhaps the medical profession is favored by easy access to preventive measures. On the other hand, should business-cycle analysts abandon all hope for preventive action? Whatever the degree of optimism, it is at least questionable procedure to consider the development of "unsound economic positions" as defensible "human functioning," whereas the severity of depressions is attributed in large part to indefensible "artificial intervention" in the recession period. Unfortunately Professor Bratt takes a strong position on this problem in his book which in other respects has the impartiality and scope desirable in an introductory treatise.

WILBERT G. FRITZ

University of Pittsburgh

Electric Power in Syria and Palestine, by Basim A. Faris. New York: Oxford University Press, Inc. (Agents). Printed at the American Press, Beirut. 1936. American University of Beirut. Publications of the Faculty of Arts and Sciences. Social Science Series No. 9. xx, 367 pp. 8*s*. 6*d*.

In his book (of 203 pages exclusive of appendices), Professor Faris traces the development of the electric industry in Palestine and in French Mandated Syria since the War. He endeavours to point out its public duty and its economic opportunity as a force in the industrial rehabilitation of those areas, in the improvement of the standard of living of their inhabitants, and in the attainment of a modicum of independence through the harnessing of natural resources. Although his public will be predominantly local, those who are interested in the problems of load development under peculiarly trying circumstances, those who would know more of the economic potentialities of these Biblical lands, and those who seek further verification of the conclusion that man seldom learns through vicarious experience will find much to interest them in *Electric Power in Syria and Palestine*. Those, however, who seek new light on the economics of electric utility operation, the determination of rates, or the analysis of costs, will be disappointed. Professor Faris demonstrates a profound knowledge neither of public utility economics nor of regulatory practice, and his analysis suffers unavoidably from the lack of important kinds of data and the inadequacies of many that were available.

Perhaps because he wrote primarily for a local audience, the mere form of presentation may irk the American reader. There is a detailed itemization of physical plant, of capitalization, and of the rate structures of the six utilities more specifically analyzed. Some confusion is caused by local currencies—more troublesome than foreign physical measures because they vary among themselves—which are seldom translated, either in table or text, into American equivalents.

But more striking in a study which purports to be an analysis of relative operating efficiency and rates is the absence of cost data of any description and of load curves either for the companies or for the classes of customers served. Professor Faris seems impressed with the efficacy of promotional rates and the conception that rates determine costs in the electric industry to the exclusion of all qualifications (by implication) of this principle admittedly true in general. His analysis of rate schedules, therefore, becomes no more than an editorial check upon their promotional character but even this is marred by a failure to consider very pertinent factors. The price and finance terms for electric appliances, the average money income by classes and the percentage of this income spent upon substitutes for electricity, the incidence of an increase in domestic demand under the more promotional rates relative to the company's peak—these data, if available, might establish some presumption for or against the efficiency of the promotional rate. Professor Faris preaches the gospel of lower rates but in the absence of supporting evidence he must rely on a comparison of average bills, average unit costs, and average customers for the United States as a whole, by major divisions, and for the Springfield Electric Company (Mass.), the Hartford Electric Light Company (Conn.), and for St. Catherines, Ontario, in particular. It need not be pointed out specifically why such a comparison is worthless to prove anything about the fairness or the business acumen displayed in electric rates in Syria and Palestine.

By implication the reader gathers that cost and load data are unavailable for the companies studied, and explicitly it is pointed out that income and financial information are inadequate for most. It is the more difficult to understand Professor Faris' conclusion that " . . . in both Palestine and French Mandated Syria the proper mechanism is provided in theory for effective regulation, and there should be no fear of unfair practices by public utility companies" (p. 222). Because the two companies in Palestine have good public relations and, with falling rates, have proved successful financially while those in Syria have suffered by comparison, it is not obvious, without far more evidence than Professor Faris marshalls, that regulation in the first instance "has shown very satisfactory results" (p. 228) but has failed in the second (p. 229).

Professor Faris demonstrates considerable ingenuity in estimating potential load from very sketchy data, but his survey of water power resources would be more meaningful if one were given some conception of the cost of harnessing and transmitting this energy to the load in comparison with the cost of steam or oil generation in this section of the world.

Lest the reader misinterpret the object of these criticisms, it should be emphasized that Professor Faris has done a very careful and painstaking job with very inadequate data. These reservations would not be stressed if, in his analysis and in his conclusions, he had shown a keener appreciation of their existence and their significance.

MELVIN G. DE CHAZEAU
University of Virginia

Determination of Confusion in Trade-Mark Conflict Cases, by Neil H. Borden. Boston, Massachusetts: Harvard University, Graduate School of Business Administration Bureau of Business Research. George F. Baker Foundation. Volume XXIII, Number 8. December, 1936. Business Research Studies Number 16. vi, 34 pp. $1.00.

Following a careful historical review of psychological studies of trade-mark confusion among consumers and of litigation based upon charges of trade-mark infringement, Professor Borden presents the recognition and recall tests used in the John B. Stetson Co. v. Stephen L. Stetson Co. case. From experience with application of these tests the author concludes that valuable evidence for judging the likelihood that consumers confuse trademarks may be derived through this procedure and that courts would facilitate decisions by admitting such evidence.

The author recognizes the limitations of his samples of men tested and claims that the results should be accepted only as a general indication. As in Business Research Studies, No. 12, by T. H. Brown, Professor Borden applies simple probability formulae with careful, concise statements of procedures and of limitations that should prove of practical value to students of sampling.

JOHN H. COVER

The University of Chicago

Population Distribution in Colonial America, by Stella H. Sutherland. New York: Columbia University Press. 1936. xxxii, 353 pp. $4.00.

Miss Sutherland's book contains thirty-five tables, three useful and original population maps, and a rather extensive bibliography (xvii–xxxii). She has divided the subject by geographical divisions, as follows: "New England," "New York," "New Jersey," "Pennsylvania and Delaware," "Virginia and Maryland," "North Carolina," "South Carolina," and "Georgia." The textual materials, in nature, are historical (economic and social) and political geography; they are interwoven and illustrated with population data into a pleasing, readable, informative, unitive but chronological story. The bibliography, which is arranged in alphabetical order, is not a critical one, but in the introduction to the story there is an explanation of the difficulties which beset the researcher in this field of population movements. The appendix is a series of tables listing the important imports and exports to and from the colonial ports of America under the English commissioners (Jan. 5, 1771–Jan. 5, 1772). The statistical tables at the end of the chapters and in footnotes showing the white and black population of towns, communities, and counties in the different colonies are of particular value, since there was no census taken by some of the colonies and the census of 1790 is inadequate for our present-day needs. Lists of kind and quantity of taxables are included. Data based on estimates are so indicated. The author's sources were limited according to records varying in quantity from colony to colony, a fact which is pointed out, and naturally the conclusions must be considered more or less valuable depending upon the quality and amount of information available. A tremendous amount of time and energy must have been spent on old newspapers, tax lists, pamphlets, and other sources, in gathering the information which is crowded into this volume. The student of population movements in America as well as the authority on the subject will find it a handbook of ready reference, and the historian may welcome it for its interesting light on frontier history and the methods used in founding new communities. The author's style is lucid; her conclusions are carefully drawn. A characteristic conclusion is one on the population density of New England about the end of the colonial period, and after a presentation of data: "Generally speaking, density appears upon the map in direct proportion to natural resources and to accessibility by water. Thus, all other things being equal the best agricultural regions attracted the early settlers, the river valleys being particularly desirable because of the ease with which they could be reached" (p. 37). Again, on New Jersey: "The idea of a town was always present in the New England mind, but of all the New Jersey communities, only one, Perth Amboy, seems to have been laid out with the prayer that it might one day become a city" (p. 118); and, finally, "the history of colonial America is the story of land" (p. 272).

WILLIAM E. SMITH

Miami University

Expenses and Profits of Limited Price Variety Chains in 1935, by Stanley F. Teele. Boston, Massachusetts: Harvard University. Publication of the Graduate School of Business Administration. Bureau of Business Research, Bulletin Number 103. Volume XXIII, Number 7. October, 1936. vi, 30 pp. $1.00.

This is the sixth of a series of annual studies of the operating figures of limited price variety chains which began in 1929 and has continued since that time with the exception of the year 1930. The current report covers thirty chain systems operating a total of 4,974 stores selling a net volume amounting in 1935 to $742,112,383. The Harvard Bureau of Business Research, which is responsible for the study, estimates that the reporting firms did approximately 90 per cent of the total business of this type which was done in the United States during that year. The 1935 Census of Distribution reported a total of 5,658 stores engaged in the variety trade. Their total sales were $709,000,000. The discrepancy between the figures of the Bureau and of the Census may probably be explained on the basis of differences in classification.

In presenting its information, the Bureau relies upon two types of averages, the "aggregate, which is obtained by dividing the total dollars reported by firms for a particular item, say salaries and wages, by the total dollar sales of the same firms," and the median. This procedure is in accordance with its usual practice in its cost reports.

The present study shows a general summary of operating results for 1935, indicating that (a) the gross margin for this year is somewhat lower than for those immediately preceding; (b) the slight rise in expenses during the year was more than offset by the increase in sales so as to cause a slight decline in expense percentages; (c) those firms operating with a 25-cent limit enjoyed the highest profit rates; (d) the larger chains achieved a rate of net profit considerably in excess of that of the smaller systems, reversing the previous tendency in this respect.

The bulletin contains a new feature in the form of a study of the tax burden borne by this type of chain system. For the firms reporting, it amounted to 1.73 per cent of sales.

The report includes a study of the year-to-year trends of the several categories of operating statistics, a discussion of the effects on operating results of differences in price limitations on articles sold, a study of the effect upon such results which is exercised by (a) the volume of net sales per firm and (b) the number of stores per firm, the influence of the average sales per store, and the size of the city in which the store is located.

A section is devoted to a discussion of the relationship between so-called "store expenses" and "overhead costs." Another valuable chapter of the bulletin compares the operating data of each of several classes of chain systems grouped on the basis of number of stores conducted by each with the average figures for the three firms in each group having the highest rates of net profit. This information should be most useful to concerns other than the three highest in each class.

This study was made in cooperation with the Limited Price Variety Stores Association. It maintains the high quality of workmanship which has been set by the Bureau in preparing and presenting operating information concerning this and other types of retail establishments.

R. S. ALEXANDER

Columbia University

Federal Support for Public Education, made under the direction of Paul R. Mort. New York: Bureau of Publications, Teachers College, Columbia University. 1936. xvi, 334 pp. $3.70.

A Measure of Taxpaying Ability of Local School Administrative Units, by Francis G. Cornell. New York: Bureau of Publications, Teachers College, Columbia University. 1936. viii, 114 pp. $1.60.

Professor Mort and his associates (Dr. Cornell, Professors Harry, Lawler, and Newcomer, and Commissioner Simpson) present in the first-mentioned book not only a program for Federal aid to education but also a formula for the distribution of such aid among the states. The minimum program proposed by Professor Mort calls for a distribution by the Federal Government of $300,000,000 annually. Each state is to receive from $6 to $12 per weighted pupil. The weighted pupil is a unit in which a high school pupil is considered as 1.7 of an elementary school pupil, and an adjustment is made to sparsity of population (necessitating substantial outlays for transportation) and to increased costs of living in urban places of different sizes. By computing the number of such weighted pupils in each state an index of the educational needs of the states is obtained.

The object of the minimum program is to guarantee to each state a school expenditure of at least $15 per weighted pupil and to equalize the state and local contributions towards the support of this program in such a way that in no state would such contributions be in excess of the state's relative tax-paying ability. It appears that some states are now spending as little as $12 per weighted pupil, and in schools for colored children even less, and that even at that they are straining their resources, whereas other states are spending $60 per weighted pupil, without any difficulty. The proposed Federal aid would result not only in an increase in school expenditures in some states but, in some of them, also in a reduction in the amounts of money raised in them for school purposes. A maximum program of Federal aid would tend to guarantee to each state a school expenditure of $60 per weighted pupil and to equalize the state and local contributions on the basis of the relative abilities of the states to contribute toward such a program.

The bulk of the book is concerned with the construction of an index of the relative abilities of the states to raise money for school purposes under a national program. This index of ability is constructed on the basis of ten factors which are seemingly related to wealth and for which figures by states are available. These factors are: the amounts of income reported for Federal income tax purposes (the aggregates of the larger incomes being considered separately from the aggregates of incomes of medium size), postal receipts, value added by manufacture, retail sales, farm cash incomes, capital stock of domestic corporations, motor vehicle registration, and population (total and urban). In the case of each one of these factors the figures by states are expressed as percentums of the national total. Thus ten series of relatives are obtained, showing for each state its proportion of the particular total. Next, these series are weighted in the light of their correlation to (or deviation from) another index of ability. This other index is prepared on the basis of estimates of the relative amounts of revenue which six selected taxes would, together, produce in each state if levied at the same rate in all states. These taxes are: personal income, corporation income, real estate, corporation organization, stock transfer, and severance taxes. Here, too, the amounts for each state are expressed as percentages of a national total. By adding for each state some of the weighted proportions and subtracting from the result others, a single or combined index is finally obtained in which the ability of each state is expressed as a percentum of the ability of all of the states.

The factors selected for this index seem to be pertinent. But the statistical data available for them are not uniformly complete and reliable. The accuracy of the method of weighting the several series is open to questioning, for the weighting is based on the degree of correlation of the series involved to an index of ability which is prepared from incomplete data and cannot be considered altogether reliable. The fact that the particular series happens to bear a close correlation to that index is not necessarily a guarantee of its correctness. Also, it is not at all clear why, in the computation of the combined index, motor vehicle registration is considered as a negative index of wealth, substractable from the total.

The second book, by Dr. Cornell, is really a supplement to Professor Mort's volume, It is concerned with the problem of measuring the financial abilities of local school districts, as a basis for the distribution among them of state school aid under a state equalization program. The author assumes that the best criterion of ability in the case is the true value of taxable real estate contained in each district, inasmuch as the bulk of the local revenues is derived from the property tax. Since it is impossible to obtain reliable figures of the true value of real estate from the figures of the assessed value, the author attempts to construct such an index from figures which are supposed to bear a close relation to property values. These are: population, retail sales, motor vehicle registration, number of income tax returns, volume of agricultural, manufacturing and mining output, postal receipts, etc. He expresses these figures in terms of percentages of the state total, thus getting for each school district the percentum ratios of its population, retail sales, motor vehicle registration, etc., to the state population, state retail sales, state motor vehicle registration, etc. To each series he gives a certain weight or coefficient of correctness. Next he combines these weighted or corrected indices in a single index, in which the ability of each district is expressed as a percentum of the aggregate ability of all districts in the state. The author believes that the index thus evolved is reliable and can be used as a basis for apportionment not only of school funds but also of other state aid.

The two books, taken together, constitute a valuable contribution to the development of scientific techniques of measurement of state and local financial abilities and deserve careful study by all students of this challenging problem. Obviously, these techniques, even if correctly conceived, require for their successful utilization complete and reliable statistical data. The data now available are unfortunately incomplete and, often, unreliable. It is hoped that this gap will be corrected in the future.

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THE COUNTING OF FARMS IN THE UNITED STATES

By John D. Black and R. H. Allen
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A census undertaking as simple as counting the farms in a country serves to illustrate several important aspects of the assembling and use of statistics in their relation to public administration. First as to the significance of such a count: the simple numbers of farms, taken at their face value, as given in the first column of the table following, indicate that the agriculture of the United States expanded until 1920, although slowly toward the end, then contracted to 1930, and has since started on a new period of expansion. The second column shows that the average size of these farms, measured in acreage, declined in 1920–25, increased strikingly in 1925–30, and decreased again in 1930–35. But the average size of farms, we shall shortly discover, is affected by the completeness of the enumeration. Counting the number of rented farms involves classifying all farms as they are counted. The numbers of these appear to have increased slowly and evenly from 1910 to 1925 and then more rapidly. The percentages of number of farms rented, on the other hand, increased rapidly from 1925 to 1930, but not at all afterward.

TABLE 1

CENSUS DATA OF FARMS IN THE UNITED STATES, 1880 TO 1935

	Number of farms	Acres of land per farm	Number of rented farms	Percentage of farms rented
1880	4,009,000	134	1,025,000	25.6
1890	4,565,000	136	1,295,000	28.4
1900	5,737,000	146	2,025,000	35.3
1910	6,362,000	138	2,355,000	37.0
1920	6,448,000	148	2,455,000	38.1
1925	6,372,000	145	2,463,000	38 6
1930	6,289,000	157	2,664,000	42.4
1935	6,812,000	155	2,865,000	42.1

If we were to examine these same data by states, we would find significant departures from these averages. Thus in the New England states the numbers of farms began to decline before 1900; but in the Mountain states they reached a new high point in 1935. In the Great

Plains states the size of farms apparently kept increasing until 1920, and in some of these states even until 1930 or 1935. The tenancy ratio remained stable from 1930 to 1935 because of a decline in the South that offset a larger increase in the North and West.

These are all significant measures of social change. They produce the sorts of data upon which agricultural programs and agricultural legislation are based. All of them are in fact used in the recent report to the President recommending farm tenancy legislation. Still more important, once such legislation is enacted, the administrators of it rely upon these data for numerous details of organization plans, prorations by areas, and the like. The trend of public policy surely points strongly toward more rather than fewer of such uses.

Now as to the statistical problem involved in counting farms: Surely it is harmless enough in appearance. But it has been solved satisfactorily by few if any census organizations. Fifteen years ago the senior writer gave up trying to make some valuable international comparisons of agriculture because the counting of farms followed so varied a procedure in different countries. Later study revealed that some countries make little attempt to distinguish farms as such. In Switzerland, the unit of enumeration is the "enterprise," and an effort is made to classify all enterprises according to whether agricultural, industrial, or the like. Agricultural holdings of less than 25 acres are classified as agricultural if crops are grown or livestock kept "for business purposes." Those above 25 acres are agricultural even if the products from them are all used by the family.[1] Forestry and agriculture are not separated. In the 1930 Rumanian census, the unit is the holding of land under one operation, irrespective of acreage, type of land-use, or location.[2] Greece made its first attempt to count farms in 1925, the term not hitherto having been used. No area limit was imposed.[3]

The reasons for the difficulties are apparent from conditions in these three countries. In Switzerland, a considerable proportion of the families combine farming with other activities. This same condition largely prevails in parts of Rumania and Greece. In Rumania, especially, a sizable fraction of the rural families have obtained a large part of their livelihood by working on large landed estates; but most of these families have patches of land ranging from a few square rods to a few acres upon which they produce part of their sustenance.

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[1] Switzerland: *Guide to Official Statistics of Agriculture, Food Supply and Population.* Part II. J. D. Black and Fritz Bachman. Published in Bibliography 35 of the Bureau of Agricultural Economics, United States Department of Agriculture.

[2] Similar publication for Rumania. Bibliography 49. Part II. J. D. Black and Constantin Ladas.

[3] Bibliography 39 in the same series. Part II. J. D. Black and Constantin Ladas.

That the conditions complicating the counting of farms in the United States differ from those described only in kind and degree is illustrated by Dr. David Rozman's study of part-time farming in a township in Massachusetts located in the outskirts of Worcester, in the course of which he obtained a report of garden, crop and livestock production for each family. He concluded that if the United States Census definition of a farm had been rigorously applied, twice as many "farms" would have been counted as the enumerator of the township finally reported in the preceding census (1925).[4] Inquiry revealed, moreover, that the enumerator had been sent back twice before he obtained as full a count as he reported. Apparently on his first trip around he had reported as farms only those commonly so recognized in the community. Evidence presented following suggests that the situation discovered by Dr. Rozman repeats itself in greater or less degree in most of the industrial Northeast and around urban centers elsewhere.

In the Southern states, the enumeration is further complicated by the counting as separate farms of small tracts of land cultivated for a share of the harvest by croppers, who are technically farmers for census purposes, but still laborers in the community mind. The part-time farming group in the South includes many who work as laborers on larger farms while operating a little land by themselves, in some cases only as croppers.

The United States Bureau of the Census has made a vigorous effort to deal with this problem. Before taking the 1930 census, it discussed the subject freely with federal officials using agricultural census data, and held conferences in which state workers and others participated. Two somewhat divergent opinions developed, one to the effect that the definition of a farm should be restricted to include only establishments commonly recognized as farms in the communities, and the other that the same definition be continued but more rigorously applied. Those interested in counting the farm population, begun in 1925, held the first opinion. Otherwise they would be confronted by the dilemma of having many heads of rural households reported as having outside occupations—perhaps factory work, carpentering, mail carrying—while also technically the operators of "part-time" farms. Another group wanted rural households with outside occupational sources of income removed from the farm totals because including them reduced average farm incomes unless outside income could also be enumerated. The procedure adopted was the compromise of keeping the same definition for the count of farms, but defining a farm for population purposes to include the clause, in italics, "and which is also locally regarded as a farm."[5] Inasmuch as the same enumerators filled in both farm and population schedules, the result was disastrous. As we shall see later, some enumerators followed one definition, some the other, and apparently many of them some uncertain combination of the two.

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[4] Unpublished information obtained in connection with his study *Part-time Farming in Massachusetts*, Massachusetts State Experiment Station Bulletin 266.

It is best to describe this episode as another mishap resulting from the attempt to introduce a count of *farm* population into the census system. Almost any important innovation of this kind is likely to produce similar disruptions. There had been a mishap when the first attempt was made in 1925, but it had mainly affected the population enumeration.[6]

The real origin of the difficulty lies in the taking of the first quinquennial census of agriculture in 1925 with no general occupational census to go with it. This, we shall see later, had introduced some important abnormalities into the count of farms in that year, and also had produced a peculiar reporting of farm population which the census officials were trying to correct in 1930.

As a guide to later enumerations, the census officials also agreed to the further compromise of using in 1930 two supplementary schedules covering agricultural production less than that normally required as minimum for a farm. One supplementary schedule, which placed the lower limit at two or more cattle or three or more hogs or the equivalent of these, was used in nearly all counties; and the other, with one or more cattle or hogs or the equivalent as the lower limit, was used in 324 sample counties. The data obtained were too incomplete and erratic to be published. Moreover, the adding of these schedules confused the enumerators and considerably affected the regular count of farms.

After much discussion and prompting from government and other users of agricultural census data, the Bureau of the Census in taking the 1935 census tried out the plan of asking the enumerators to report a farm schedule for every establishment having any appreciable agricultural output, leaving to the central staff the job of classifying these as farm or non-farm. Partly as a result of this change in census procedure, but also in part because of actual changes in agriculture, the 1935 census reported a half million more farms than that of 1930; and the increases mostly appeared in the areas where part-time farming is prevalent. The 1935 farm population count was in general increased by the inclusion of the families on the farms brought in for the first time by the new procedures; and also affected in other ways not so clearly apparent. The writers have not dealt with this phase of the subject in the pages following. They are expecting it to be treated in a forthcoming report of the National Resources Committee. The principal objective of this article is to review the efforts of the Federal Census to obtain a better count of farms, especially in recent decades, and to analyze the effects of changes introduced, as a basis for planning the 1940 census.

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[5] *Instructions to Enumerators—Population and Agriculture*, Fifteenth Census of the United States, p. 25.

[6] The undercounting of farm population in 1925 had caused the Department of Agriculture to overestimate the migration from farms to cities in the decade of the '20's.

DEFINITION OF "FARM"

In terms of area, 3 acres or more of land under one management upon which agricultural operations are conducted has been the accepted census minimum for a farm in the United States since 1870, except in the count of 1900 when no lower limit of any kind was specified except that market gardens and the like must employ the time of at least one man. The censuses before 1900 also accepted places of less than 3 acres as farms if they had $500 worth of products. Since 1910, this figure has been $250.

Dropping the minimum specifications in 1900 increased the count somewhat. Thus 41,000 farms under 3 acres were reported in 1900, of which 29,000 had less than $250 worth of production; and imposing the $250 limit in 1910 caused only 18,000 farms under 3 acres to be reported.

The deficiencies in this definition that have become apparent are as follows:

(a) It does not agree with local ideas of a farm in that it includes not only smaller establishments, but also many which are largely dependent upon other sources of income. The related difficulty with croppers and laborers in the South has already been stated. Under these circumstances, local enumerators cannot generally be expected to report according to instructions.

(b) The definition itself imposes no real production requirement upon a farm of 3 acres or over. Large numbers of these have very little agriculture upon them, consisting mostly of uncultivated land. This of course confuses the enumerators. The census officials probably eliminate some of these in the editing process but have never published a statement on this point that might serve as a guide to users of the census data.

(c) Stating the minimum in dollars does not allow for changing values of farm products, such as occurred from 1919 to 1924, and from 1929 to 1934. The evidence clearly suggests that the number of small farms reported has been affected by this.

The proposal to meet these difficulties by asking enumerators to report only what are locally regarded as farms has not been acceptable to users of census data. They fear that the count thus obtained will vary with local ideas as to what constitutes a farm, and from one census to another with changing enumerators, so that they will never know what really is counted as a farm. Those who have followed the subject closely are generally of the opinion that the enumerators should be instructed to report all agricultural production on any place, letting the central staff do the classifying in the office. They hope that other types of classification besides mere size in acres can be developed, the "part-time" grouping made in 1935 furnishing an example of such a classification. They would like the census reports to indicate clearly the limits of the classes, as did the type-of-farming reports of the 1930 census. What they want, therefore, is continuation along lines developed in the 1930 and especially the 1935 census. They particularly want no abandonment of the procedure started in 1935 of having the enumerators report all possible farms, even though, as will appear later, it did not achieve its full intent at the first attempt.

COUNTING OF FARMERS

Any counting of farms is also likely to be confused by an attempt to count the number of "farmers" at the same time, as in all the regular decennial censuses. To be counted as a farmer in the occupation part of the census, a man needs to have farming as his principal source of income; but many heads of households living on farms earn more as factory workers, miners, roadworkers, carpenters, mail carriers, and the like, than from their farming activities. Table II shows that in the earlier censuses, more farmers were reported than farms, due mainly to certain difficulties over farms operated by tenants and croppers in the South, and over ranches upon the public domain in the West. An attempt was made in 1900 to identify farm and occupation returns, thus to have a farm for each farmer; and this practice has been continued since. But this does not entirely solve the problem for the enumerators. They tend to report farming as the occupation of the head of the household on every place for which they take a farm schedule; or conversely, take a farm schedule only for those households which report farming as the principal source of income. This cannot fail to distort the count for both. Apparently in 1930, the enumerators more commonly chose the second of these alternatives. The 1935 procedure went a good way toward meeting this difficulty; but not far enough, it will presently appear. There should be a greater excess of farms over farmers than has appeared in any census to date.

TABLE II

CENSUS COUNT OF FARMS AND FARMERS,* UNITED STATES, 1880 TO 1930

	Farms	Farmers
1880	4,009,000	4,327,000
1890	4,565,000	5,427,000
1900	5,737,000	5,637,000
1910	6,362,000	6,199,000
1920	6,448,000	6,387,000
1930	6,289,000	6,012,000

* Includes in 1920. Farmers, general farms, dairy farmers, stock raisers, florists, fruit growers, gardeners, landscape gardeners, nurserymen, apiarists, and poultry raisers; and the nearest equivalent of these classes in other census years. In 1910 and 1920, turpentine farmers could not be separated from "farmers," and in 1910 "poultry yard laborers" from "poultry raisers." Similar minor difficulties were encountered in other years.

PECULIARITIES OF THE QUINQUENNIAL CENSUS

Although the complications of simultaneous counting of farms and farmers do not arise when an independent farm census is taken, as was the case in 1925 and 1935, certain advantages of such counting are also lost. Thus, not having at such times to locate farms under 3 acres to obtain population data for them, the enumerators fail to find large numbers of them. The census of 1930 reported 38,263 such farms compared with 15,151 in 1925 and 35,558 in 1935. The instruction to enumerators in 1935 to bring in all farms apparently was partly effective with this group of farms. It brought in nearly as many as the 1930 census; but the 1930 census was very incomplete for all small size groups.

The next two size groups, 3 to 9 acres and 10 to 19 acres, were no doubt also affected in 1925 by this same tendency toward being overlooked, but in less degree. Actually more farms were reported in these groups in 1925 than in 1930 in a majority of the geographic divisions, including all the divisions with a significant amount of part-time farming in them, and scattering states or groups of counties of the same description elsewhere. The reason for this is that in the regular decennial censuses, large numbers of these are omitted from the farm count as soon as the enumerators discover that the head of the household has a regular job or occupation off the farm.[7] This tendency apparently more than offsets the tendency in quinquennial censuses not to locate small farms in all size groups except that of under three acres.

[7] The 1920 count was lower than the 1925 for the 3- to 19-acre groups in all geographic divisions.

Hence neither type of census represents a complete enumeration. The count of farms in the 20- to 49-acre size groups in 1930 indicates the same type of omissions, though in lesser degree in six of the nine geographic divisions. Careful comparisons of 1925, 1930 and 1935 totals by size groups and by geographic divisions indicate that as many as 300,000 farms may have been omitted in 1930 which were included in one of the other two years.

Such an estimate, however, can have no secure basis as long as derived from the census data themselves because of the changes in census procedure.[8] Part of the increase in numbers reported by the census in 1930–35 no doubt reflects an actual increase in part-time farming and resumption of subsistence farming in this period. Probably there was a fairly steady increase of part-time farming during most of the period from 1925 to 1935, a continuation of a movement well started before 1925. Such evidence as we have indicates no acceleration of the movement in the depression of the '30's.[9] The 1930 census reported too little of the movement; and the 1935 census, while reporting more of a change since 1930 than occurred, nevertheless failed to inventory the full absolute amount of part-time farming, not only because of the omission of farms under 3 acres already noted, but also because of remaining incompleteness of count even in 1935, to be discussed presently.

The 1925 census was peculiar in omitting many of the larger farms. In Table III, it will be noted that six of the geographic divisions reported increases in 1930 in farms of 175 acres or more as compared with decreases in 1925. The remaining three divisions reported much smaller decreases than during the preceding period. State censuses taken in 1925, especially the excellent state census of Iowa agriculture, indicate that these sizable decreases in numbers of large farms did not generally occur. The table only roughly reveals this census phenomenon. The size groups most clearly affected by it vary by divisions.

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[8] The extreme range of possible estimates is from 180,000 to 480,000.

[9] Significant evidence that no acceleration occurred lies in the fact that the 1935 census reported only 572,000 farm operators as engaged in non-agricultural work off the farm for 150 days or more, as compared with 540,000 in 1930. The 1935 figure is only 8.3 per cent of the number of farms in that year, as compared with a corresponding 8.5 per cent in 1930. No significant differences in changes by geographic divisions appear: the New England states were highest in both years, 20.7 and 19.0 per cent respectively; the West North Central states lowest, 5.1 and 5.0 per cent respectively. These data are subject to the limitations imposed by the omissions already discussed, but since these omissions were most serious in 1930 the effect is to overstate the increase in outside employment. Professor I. G. Davis has even concluded that the movement was retarded in 1930–33 because of a shortage of resources of would-be part-time farmers—" . . . this increase in part-time farming occurred more rapidly between 1920 and 1930 than it did after 1930. After 1930, the movement toward part-time farming was retarded by the economic depression." (*Types of Farming and Type-of-farming Areas in Connecticut;* Storrs Agricultural Experiment Station Bulletin 213, p. 29.) Recent studies in Southern territory have revealed a strong movement toward part-time farming, particularly since 1930.

In Iowa and Kansas, for example, the groups above 260 acres show it most strikingly.[10] Omission of these larger farms in 1925 so seriously disturbed the totals for acreage and output of many farm products that the Division of Crop and Livestock Estimates had difficulty in using them as bases from which to compute year-to-year estimates of change. The table suggests that this difficulty was overcome in the 1935 census.

TABLE III

PERCENTAGE CHANGE IN NUMBER OF FARMS, 175 ACRES AND OVER, REPORTED BY THE LAST FOUR CENSUSES, BY GEOGRAPHIC DIVISIONS

	1920 to 1925	1925 to 1930	1930 to 1935
New England	−10.4	−1.6	3.0
Middle Atlantic	−10.8	2.2	2.6
E. N. Central	−3.4	7.2	2.8
W. N. Central	−1.7	6.4	4.2
South Atlantic	−9.8	−3.3	15.7
E. S. Central	−14.1	−1.3	11.0
W. S. Central	−7.2	16.2	9.8
Mountain	−9.6	1.6	4.6
Pacific	−11.0	0.6	1.4

METHODS OF ANALYSIS

Exactly how incomplete the 1930 enumeration of farms was, and how much of the increase of a half million farms reported in 1935 was due to correcting for this, how much to the use of new methods that counted more places as farms than ever before, and how much to an actual increase in part-time or subsistence farms, or resumption of activities upon essentially subsistence farms, cannot be determined with a finality that will confound all those who may have reason to disbelieve. Nothing short of carefully controlled surveys made soon after the census enumerations would suffice for such a purpose. Several types of analyses can be made, however, which will convince almost anyone doing the actual job of analysis that somewhat the larger portion of the increase was due to the first two influences.

One of these types of analysis is a comparison of changes between census periods by size groups for separate states. The consistency of these reported changes with the circumstances and explanations stated above leaves little room for reasonable doubt. The writers respectfully ask any doubting person to turn to the size group data for his state for 1920, 1925, 1930 and 1935 and relate the changes he observes to the circumstances here related connected with the taking of these censuses; and then do the same for several states in other parts of the country. Another method of analysis is to compare by counties the changes in number of farms between censuses, and then relate these to changes in numbers by size groups. Most convincing of all, is to record on a map by townships the number of farms reported in each of the censuses since 1925, if the data have been obtained that far back. Those since 1930 will be highly informative.

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[10] The most plausible explanation thus far suggested for the relatively full counting of small farms in 1925, and relatively incomplete counting of larger farms, is as follows: The enumerators in 1925 were paid on a per-farm basis. They could make the best money where farms were small and close together; but were inclined to omit doubtful places for which pay might be refused. They could not make wages trying to canvass large farms or thinly settled areas. By contrast, the 1930 enumerators secured their best pay from listing people for the population count. The agricultural schedule was long and the pay low in proportion to time involved. Hence, it was easy to list population and let the agricultural schedule go in all anywise doubtful cases.

The writers have not been able to perform these analyses for the whole United States. The first type of analysis was used for a majority of the states; the second for ten selected states; and the last for selected towns in New England. Space does not permit including the detailed results of these analyses. Only a few samples and summaries can be presented. In choosing New England for the more detailed analysis, the writers were aware that they would find there in pronounced form the manifestations to be observed. They expected to learn from New England not the extent of the under- and over-enumeration, but the nature of it and the reasons for it. They were seeking here for a qualitative explanation, not a quantitative measurement to be extended to the rest of the country.

THE ENUMERATION IN NEW ENGLAND

Table IV presents a comparison of census counts by states of New England from 1910 to 1935. Conceivably the apparent definite reversal of trend in 1920–25, the very sharp decline to 1930, followed by expansion to 1935, could really have happened. But other available evidence indicates instead a steady downward trend, slackening at the end in southern New England, and probably turning upward somewhat here in 1930–35. The comparison in terms of size group changes strongly supports this description. The direction and percentage amplitude of change are approximately the same for Massachusetts and Connecticut—up slightly in 1925, down sharply in 1930, and up very sharply

TABLE IV

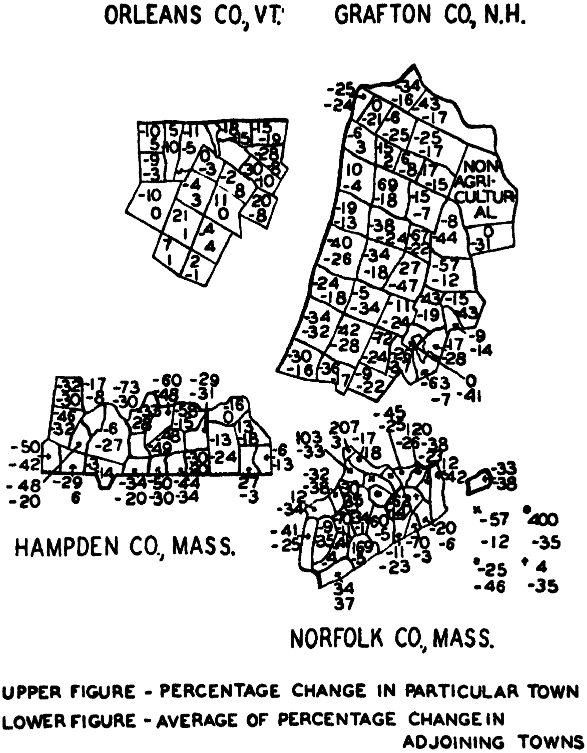
CENSUS COUNTS OF NUMBER OF FARMS IN NEW ENGLAND, 1910 TO 1935

	1910	1920	1925	1930	1935
Maine	60,016	48,227	50,033	39,006	41,907
New Hampshire	27,053	20,523	21,065	14,906	17,695
Vermont	32,709	29,075	27,786	24,898	27,061
Massachusetts	36,917	32,001	33,454	25,598	35,094
Rhode Island	5,292	4,083	3,911	3,322	4,327
Connecticut	26,815	22,655	23,240	17,195	32,157
Total for New England	188,802	156,564	159,489	124,925	158,241

in 1935—for all size groups under 49 acres. This statement roughly fits Vermont, New Hampshire, and Maine for the size groups under 19 acres. In northern New England, the size groups from 20 acres upward turned sharply downward in 1930 and recovered only part way in 1935. In southern New England, the size groups above 50 acres showed only a slight downward tendency in 1930, which was roughly offset in 1935. These trends are entirely consistent with a more complete enumeration of small farms (except those under 3 acres) in 1925 than in 1920, a less complete enumeration in 1930 and an enumeration in 1935 even more complete than that of 1925. These tendencies characterized all of New England, but were more pronounced in the more industrialized areas.

CHART 1

PERCENTAGE CHANGES BY TOWNS IN NUMBER OF FARMS REPORTED, CENSUSES OF 1925 AND 1930, FOUR COUNTIES OF NEW ENGLAND


ORLEANS CO., VT.
GRAFTON CO., N.H.
NON AGRICULTURAL
HAMPDEN CO., MASS.
NORFOLK CO., MASS.
UPPER FIGURE - PERCENTAGE CHANGE IN PARTICULAR TOWN
LOWER FIGURE - AVERAGE OF PERCENTAGE CHANGE IN ADJOINING TOWNS

The extreme variations between towns in the same county, which certainly must be due in large measure to variations in the enumeration, are indicated by Chart 1, which compares the changes for the towns in four counties with the average changes of the immediately adjoining towns, to obtain a rough measure of the extent of erraticness in the 1925–30 changes. Orleans is one of the most agricultural counties of New England, and Grafton a rough county abutting upon the White Mountains. Hampden gives us a cross-section of the Connecticut River Valley, and Norfolk an area near a large city. That these differences appear in adjoining towns generally throughout New England is evident in Chart 2, in which increases and decreases are shown on the same map according to their magnitudes for the following five-year period, 1930–35. In general, the increases are large near the cities, but without much regularity, and some surprising increases appear elsewhere. The decreases have this much system that for the most part they are localized in certain counties, especially in Maine and northern Vermont. This map and a size-group analysis, which space does not permit including, strongly suggest a relative under-enumeration in Maine in 1930 of farms under 20 acres especially, and the same in lesser measure for Vermont.

The exceptional enumeration given Connecticut in 1935 requires special consideration. In this JOURNAL in September, 1933,[11] Professor I. G. Davis of Connecticut State College compared the results of a survey of 12 Connecticut towns conducted under his direction in 1931 with those of the 1930 census. In 1934 he re-surveyed the same 12 towns and added 39 new towns to his sample.[12] The same definition of a farm was used as in the census except that no establishments with less than 3 acres of land were included. The results were fairly consistent with the 1925 census count, the differences with a few exceptions being only such as might have occurred in the intervening periods. The 1925 census, as explained above, probably omitted very many of the farms of under 3 acres. The survey omitted all of them by definition. The 1930 census count probably should have been larger than the 1931 survey count because of including more farms of less than 3 acres. In all but two towns the reverse was true. A size-group comparison for Connecticut indicates that the omissions occurred most strikingly in the groups under 49 acres.

Now as to the 1935 census count: in 15 towns it does not vary more than 10 per cent from the 1934 survey; in 31 it is more than 10 per cent larger; and in the remaining 5 it is more than 10 per cent smaller. It would therefore appear that in a majority of towns, the enumerators followed their 1935 instructions with a fair degree of consistency. The

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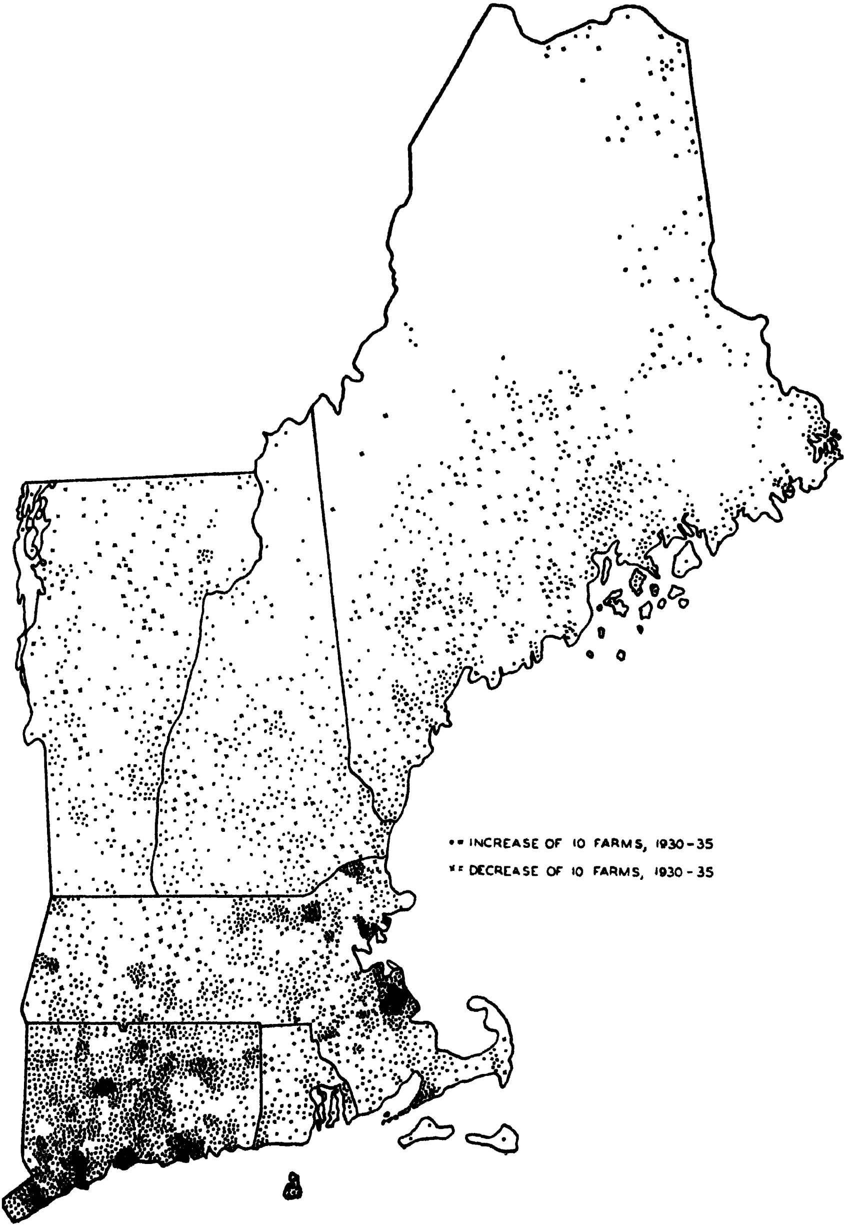
[11] Pp. 272–85.

[12] Data from this survey were kindly supplied by Professor Davis.

CHART 2

CHANGES BY TOWNS IN NUMBER OF FARMS REPORTED, CENSUSES OF 1930 AND 1935, NEW ENGLAND


• INCREASE OF 10 FARMS, 1930-35
× DECREASE OF 10 FARMS, 1930-35

census administrators had become acutely aware of the difficulty of counting farms in southern New England, and in Connecticut in particular, and made a determined effort to obtain a reporting of all places with any agriculture at all. Of the schedules returned, several thousand, principally in the smaller size groups, were sorted out in the editing process because of having too little agriculture upon them. Some small farms may still have been omitted by the enumerator in the towns showing small excesses of census over survey counts. The excess of the census over the survey in a majority of the towns probably consisted partly of farms under 3 acres not included in the survey and partly of farms of over 3 acres having relatively little agricultural production which were omitted in the survey. A few may have been part-time farms developed after the survey was made, and a few others may represent omissions in the survey.

The farms of under 3 acres included in the census but not in the survey were no doubt mostly farms properly included under the census definition; and no doubt many of those of over 3 acres omitted in the survey. When the census count exceeds the survey count, it probably represents more nearly a true count in terms of the census definition as it is written (but not commonly applied).

Among the 51 towns, however, were 9 in which the survey count exceeded the census count, in one case by 80 per cent. Comparison of the two sets of data indicates that the enumerators in these towns failed to follow the revised census instructions consistently. Some did not follow them at all. We may therefore conclude that because not all the enumerators followed the revised census instructions of 1935, and others probably followed them with less than full consistency, there was still some undercounting of farms in Connecticut in 1935, as compared with a counting under a strict application of the census definition. The undercount could easily have been as much as two thousand farms.[13]

It therefore appears that even the 1935 counting of farms in New England was far from complete and seriously erratic. The enumeration in Connecticut approached a full count, but was probably still incomplete in many towns. The evidence points to much more undercounting in the rest of New England, especially in Maine and northern Vermont. This undercounting, it should be borne in mind, is relative to the actual number of establishments meeting the census definition, not relative to earlier censuses, which were still more incomplete.

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[13] Uncertainty as to what the census practice really is for farms of over 3 acres having small output makes such estimates as this very hazardous.

THE ENUMERATION ELSEWHERE

How much like the New England enumeration was that of the rest of the country? The states included in Table V represent most of the important sets of conditions found in the United States. The Pennsylvania data show a sequence of changes much like that for New England as a whole. The Iowa and Kansas data differ in showing no decrease in 1930; there are relatively few part-time farms in these states to disturb the enumeration. Indiana and Wisconsin are intermediate between Pennsylvania and Iowa. Virginia data show some southern influence, but much resemble those for Pennsylvania. They also roughly describe the changes in Maryland, Delaware, West Virginia, and even fit Kentucky and Tennessee fairly well. In California the pattern of change is roughly that of New England imposed upon an upward trend line. This same description fits Wisconsin and Minnesota in some measure. The Alabama data roughly fit the cotton states except that Georgia and Mississippi had fewer farms in 1935 than in 1930.

TABLE V

CENSUS COUNT OF NUMBER OF FARMS FOR SELECTED STATES, 1920 TO 1935

	1920	1925	1930	1935
Pennsylvania	202,250	200,443	172,419	191,284
Virginia	186,242	193,723	170,610	197,632
Alabama	256,099	237,631	257,395	273,455
Wisconsin	189,295	193,155	181,767	199,877
Indiana	205,126	195,786	181,570	200,835
Iowa	213,439	213,490	214,928	221,986
Kansas	165,286	165,879	166,042	174,589
Wyoming	15,748	15,512	16,011	17,487
California	117,670	136,409	135,676	150,360

We may therefore conclude that the data resemble those for the New England states in showing a decline in 1930, or at least a much smaller rate of increase, except in the South and the Western Corn Belt, and a pronounced upturn to 1935 in nearly all sections. However, this upturn is not as pronounced as in New England, and is least in the Western Corn Belt and some parts of the South.

The explanation of many of these changes may be discovered from a study of Table VI, which presents significant size-group data for these same states. The undercounting of farms of less than 3 acres in 1925 is apparent in every state. This undercounting was much less in 1935. All the states with the possible exception of Wyoming show evidence of underenumeration of farms in the 3- to 19-acre groups in 1930, if we may judge by the relatively large increases evident in 1935. These increases appear to be much larger than could be explained by the development of part-time and small-scale farming. The undercounting was largest in the eastern states and the Great Lakes states like Wisconsin. The considerable increases of farms of 175 acres and over in 1930 reflect in part the undercounting of large farms in 1925. The increases of these large farms in the 9 states in 1930–35 probably represent actual trends. A detailed analysis of size-group changes by individual states, which could not reasonably be presented here, supports the generalizations derived from these two tables.

TABLE VI

PERCENTAGE CHANGES IN COUNTS OF FARMS FOR CERTAIN SIZE GROUPS, FOR 9 SELECTED STATES

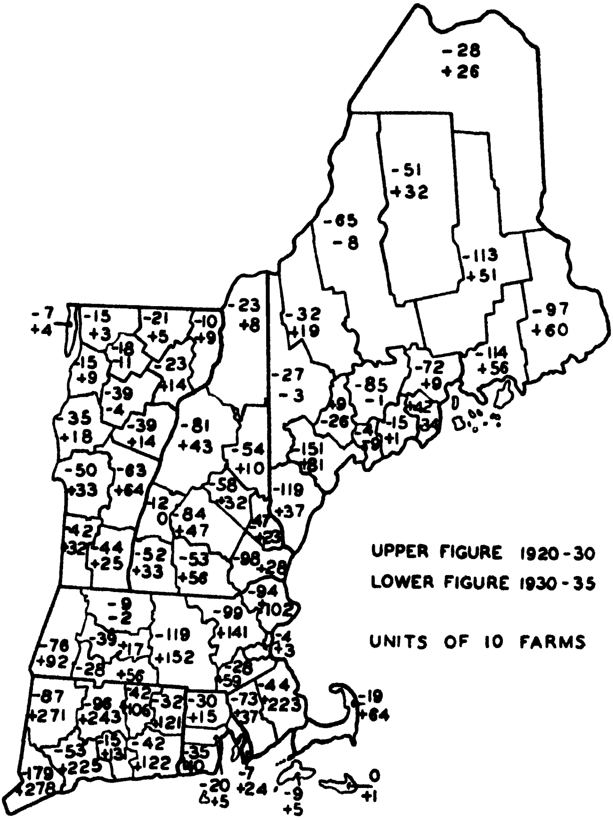
States	Under 3 acres		3 to 19 acres		175 acres and over	
	1925–30	1930–35	1925–30	1930–35	1925–30	1930–35
Pennsylvania	+ 103	−48	−31	+45	+5	0
Virginia	+ 325	+ 3	−31	+57	−1	+ 5
Alabama	+ 296	−24	+ 6	+42	0	+22
Wisconsin	+ 236	−36	−30	+59	+7	+ 9
Indiana	+ 293	0	− 9	+47	+9	+ 2
Iowa	+ 960	−58	+10	+28	+5	+ 1
Kansas	+1201	−69	+ 7	+49	+6	− 1
Wyoming	+ 22	−23	+90	+77	+1	+ 4
California	+ 113	−21	− 4	+27	+2	+ 3

Another approach is to compare the changes between censuses county by county, placing the results upon outline maps as in Chart 3 for the six New England states. Such maps were prepared for seven other states. In general the changes in the East are in opposite direction, first minus and then plus, for 1920–30 and 1930–35 as in most of New England. Pennsylvania furnishes only six examples to the contrary. In the South, however, there are many counties, sometimes grouped and sometimes scattering, where continuous increases or decreases appear. Many California counties show continuous increases. The same is true of Iowa and Kansas, but the increases are small. In the newer states with few part-time farms, the general upward trend is ordinarily enough to offset the relative undercounting in 1930. One would really need measures of departure from trend to detect effects of enumeration practice in much of this territory. The principal evidence of erratic counting of farms in these maps takes the form of occasional difference in direction and amount of change in adjoining counties for which no adequate other explanation is available. Thus the data for Jefferson County, Wisconsin, indicate a decrease throughout the period, whereas all the surrounding counties show first a decrease and then an offsetting increase. Obviously this approach to the problem gives no conclusive answer. It merely makes one wish for data that do report the actual changes that occurred.

More needs to be said about the enumeration in the South. Apparently there was an actual decline in numbers of farms in 1930–35 in many of the strictly cotton counties of the South. An analysis of the data for 170 such counties, selected so as to exclude those in 1930 with cities of 10,000 or over in them, with less than 40 per cent of their land in cotton and less than 1000 croppers, made by Frey and Smith of Louisiana State University[14] indicates that the number of croppers in these counties decreased 11 per cent and the number of other tenants one per cent. Table VII shows fairly conclusively that this came about through the combination into larger farms, at least in the enumeration, of farms chiefly in the size group from 20 to 49 acres. In terms of numbers, the decrease for this size group more than offset the increase of

CHART 3

CHANGES BY COUNTIES IN NUMBER OF FARMS REPORTED, CENSUSES OF 1920, 1930, AND 1935, NEW ENGLAND



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[14] *Rural Sociology*, Vol. 1, December, 1936, pp. 483–505.

larger farms for six of these nine states; but the acreage involved in the increases was greater than that in the decreases, and hence total land in farms increased for all of these states. There are at least two possible explanations of this reported combination of the medium-sized farms into larger farms. One is that an increase in the use of machine cultivation in cotton growing has made possible an increase in size of farms with consequent substitution of hired laborers for croppers. This factor is applicable chiefly in the western portion of the Cotton Belt. The A.A.A. program together with widely fluctuating cotton prices was probably responsible for some part of this development, although the evidence on this point is not clear.[15] Public work relief no doubt contributed to the same effect by providing employment between the peak periods of employment on the plantations. Mapping of the changes by counties also shows sufficient grouping of the decreases, such as in the Yazoo Delta counties, and the Black Waxy Prairie of Texas, to support a theory of actual decrease in numbers in these and other sections. There is even more grouping of increases in the mountain counties of the South, and around a few urban centers like Birmingham where subsistence and part-time farming are prevalent.

TABLE VII

CHANGES IN NUMBER OF FARMS BY SIZE GROUPS BETWEEN 1930 AND 1935 FOR SELECTED COTTON-GROWING STATES

	Under 20 acres	20-49 acres	50 acres and over
North Carolina	+14,637	− 3,064	+ 9,686
South Carolina	+ 5,631	−10,052	+11,994
Georgia	− 60	−21,809	+16,815
Tennessee	+23,222	− 39	+ 3,943
Alabama	+16,136	− 8,485	+ 8,409
Mississippi	+15,053	−22,797	+ 6,764
Arkansas	+13,087	−11,357	+ 8,949
Louisiana	+ 9,458	− 4,364	+ 3,677
Texas	+15,977	−16,625	+ 6,176

Outside of these particular sections, which include most of the counties studied by Frey and Smith, the pattern of change, although generally upward in 1935, as in the New England states, is sufficiently irregular as between counties in the same section to suggest that differences in enumeration in many cases may have more than offset the actual changes. This points to the conclusion that differences in enumeration procedure also affected the count elsewhere, but not enough to obscure the large actual changes occurring.

Georgia and South Carolina present a particular problem. Table VII shows an actual decrease in numbers of small farms in Georgia, and only a small increase in South Carolina. There is a fully compensating increase in numbers of larger farms. But these changes nevertheless set these states out in sharp contrast with the rest of the South. Special conditions probably are responsible for these differences; but the manner in which they coincide with state boundaries is somewhat disconcerting, at least faintly suggesting that the count for whole states may have been affected by enumeration procedure, as already pointed out for New England.

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[15] Nourse, Davis and Black, *Three Years of the Agricultural Adjustment Administration*, pp. 340–53.

The census count of Southern farms in 1925 and 1930 was more irregular than that of 1935, if we may judge by the size-group analysis. Thus, relative to other southern states, North Carolina was high in 1925, and then low in 1930, in the size groups under 20 acres. Mississippi and Texas had large increases in these groups both in 1925 and in 1930. In the next larger size group, 20–49 acres, North Carolina and Texas showed large increases in 1925; but in 1935 North Carolina continued upward and Texas turned downward. These are merely instances of the varied pattern of change reported for the smaller size groups. These differences may be wholly explained by special circumstances such as the passage of the crest of the boll-weevil wave across the South from west to east; but they may also reflect in part a variation from state to state in census practice with respect to the counting of cropper units.

The geographical distribution of the 1930–35 changes in numbers of small farms, on the other hand, suggests that the enumeration of small owner farms affected the results fully as much as the enumeration of croppers. It is true that while the owner farms in 10 southern states, North Carolina to Texas and Oklahoma, increased 13 per cent in 1930–35, the cropper farms decreased 12 per cent. But there are many more owner than cropper farms. The number of other rented farms remained the same. These statements are consistent with the 7 per cent increase in total population in these same Southern states between 1930 and 1935, compared with less than one per cent in eleven North Central states exclusive of the border states.

The extent to which part-time farming entered into the farm counts of 1930 and 1935 is suggested by the fact that for the 200 counties of the United States, North, South and West, selected by the 1930 Census of Manufactures as having industrial importance, the 1935 census reported an average increase of slightly over 500 farms. These counties contained one-fifth of all the increase in farms reported in this period. How much of this was actual increase in part-time farming and how much was due to census counting, we shall probably never know.

Reference has been made in several places to resumption of farming as a factor, along with increase in part-time farms, in the increased count of farms in 1935. The two can scarcely be separated. In many cases, no changes of situs of the family was involved. Having less employment in industry in 1933 than in 1930, they depended more upon their land and were more likely to call themselves farmers. But in some sections there was actual resumption in the sense that families moved upon farms that had been temporarily vacated. But scattering evidence from many sources indicates that these two forms of resumption did not account for any large part of the increase in the count.

The foregoing is by no means a full coverage of all the factors affecting the completeness of the enumeration of farms at the different census periods. No doubt the changes in date of taking the census affected the number of cropper and tenant tracts counted as farms. The spring date of taking the 1930 census apparently contributed to the peculiarities of that enumeration. As already suggested, the change in the price level caused fewer establishments of less than 3 acres to be counted as farms in 1935. But all of these appear to have been minor factors when measured against those here analyzed. Their influence on other items in the census, such as number of livestock or farm laborers, has been of much more importance than upon number of farms.

SUMMARY STATEMENT

At this point we may bring our analysis to certain conclusions. The methods used, while offering no incontrovertible evidence as to the 1935 count of farms outside of New England, furnish strong presumption to the effect that as large a percentage of the farms in the smaller size groups were omitted in most of the northern and western states as in New England. Because of the lesser proportion of small farms, however, the effect of this undercounting on the total number of farms was relatively not so important elsewhere, especially in the Corn Belt and the West. As for the South, the question is so involved with the counting of cropper farms that we must speak more qualifiedly; but no doubt there was appreciable undercounting of small farms here also.

But as compared with the 1930 census count, that of 1935 was unusually complete. It was the most complete count ever made with the possible exception of that of 1900. The 1930 count was the least thorough of any since 1890. The omissions in 1930 were mostly part-time farms in the size groups under 50 acres. The 1910 and 1920 censuses had omitted very many of these. The 1925 brought some of these into the enumeration. The 1930 census dropped these and some that had been counted in 1920. The 1935 census brought all of these back and more besides. But even it failed to get large numbers of them in most towns outside of Connecticut and in many towns even in Connecticut. The number of farms involved in the changes in enumeration behavior for 1920 to 1935 was a considerable percentage of the total number only in the Northeastern states, in industrial counties scattered over the country, and in a few scattered areas such as the southern Appalachians, the cut-over regions of the Great Lake states, and some sections of the Pacific states. But it affected the count of farms by at least several thousand in most of the states. If all the farms conforming to the census definition had been counted in 1935, the total might well have shown a further increase of a few hundred thousand in addition to the half million increase reported.

RELATED EFFECTS

Obviously the proportion of farms counted cannot be changed as extensively as since 1890 without its affecting the enumeration of land in farms, livestock and many other items. But the effect on these items will not be as great as upon numbers in any case where the smaller farms are mainly involved. Thus apparently the omission of relatively few of the larger farms in the 1925 enumeration made the farm production data less usable than did the omission of several times as many small farms in 1930. That the effects in 1930 were still important, however, is demonstrated by the data in Table VIII. The 1930 census reported 10 per cent less land in farms in New England than the low 1925 enumeration, the percentages ranging from −2 in Vermont to −18 in Connecticut, whereas the 1935 census showed an average increase of 8 per cent, the percentages ranging from +2 in Maine to +38 in Connecticut.

TABLE VIII

PERCENTAGE CHANGES IN LAND IN FARMS IN NEW ENGLAND REPORTED BY CENSUSES SINCE 1920

State	1920–25	1925–30	1930–35
Maine	− 5	−10	+ 2
New Hampshire	−13	−13	+ 8
Vermont	− 7	− 2	+ 4
Massachusetts	− 5	−15	+ 9
Rhode Island	− 7	−10	+10
Connecticut	− 4	−18	+38
New England	− 7	−10	+ 8

The effects of the relative underenumeration of land in farms in 1925 and 1930 are apparent for the United States as a whole in Table IX. A comparison of the 1935 data by size groups with those for 1920, the last "normal" census, suggests that as many as 2,000,000 acres above the last "normal" enumeration, that of 1920, may have been brought in by the new methods employed in 1935. Similar analysis, with allowance for trends, suggests that had the 1925 and 1930 enumerations been "normal," the total for the United States would have been around 50,000,000 acres larger in 1925, and 17,000,000 acres larger in 1930.[16] Could a really full enumeration have been taken in 1935, another 5,000,000 acres of land in farms might have been found. It would mostly have been in farms with very small acreages.

TABLE IX

PERCENTAGE CHANGES IN LAND IN FARMS BY GEOGRAPHIC DIVISIONS REPORTED BY CENSUSES SINCE 1920

Divisions	1920–25	1925–30	1930–35
New England	− 7	−10	+ 8
Middle Atlantic	− 8	− 7	+ 4
E. N. Central	− 4	− 2	+ 5
W. N. Central	− 3	+ 7	+ 3
South Atlantic	− 9	− 2	+10
E. S. Central	−11	+ 3	+ 8
W. S. Central	− 5	+10	+ 9
Mountain	+11	+16	+ 9
Pacific	− 3	+10	+ 3
United States	− 3	+ 6	+ 6

The best evidence as to incompleteness of the land enumeration even in 1935 is of the same order as that for the farm enumeration—wide variations in the amount of change in neighboring towns, amounting in many instances to differences in direction of change. The variations for New England towns are almost as striking as those given in Chart 2 for numbers of farms. They will not be as pronounced outside of the Northeast because the part-time farms elsewhere do not commonly have considerable largely unused land attached to them.

The effect of the adjustment to the 1920 "normal" upon the average size of farms in the United States might have been about as follows:

Years	1920	1925	1930	1935
Reported average	148	145	157	155
Adjusted average	148	152	153	158

The 1925 reported average was lowered both by the inclusion of more small farms than in 1920, and the omission of many large farms; the

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[16] The methods used in deriving these estimates may be illustrated as follows: In many of the larger size groups in the Northeast a sharp decline in acreage was reported from 1920 to 1925, a slight recovery to 1930 and a pronounced upward trend to 1935. The assumption was made in such cases that actually the trend was downward at a uniform rate from 1920 to 1930, but that the acreage did not go as low as the 1930 census indicated and that the trend to 1935 was less sharply upward than indicated by the census data. In parts of the South where boll weevil infestation caused a considerable abandonment of farm land between 1920 and 1925, the low point was reached in 1925 with a continuous upward trend from 1925 to 1935. In such cases the effects of underenumeration in 1925 and of actual decreases could be separated only arbitrarily, about half of the change being attributed to each factor. It should be clearly understood that the results arrived at by these methods are not looked upon as estimates which could be used in correcting the reported figures, but rather as indicative of the magnitude of the error that may easily have resulted from the methods that were used.

1930 reported average was raised by the restoration of the large farms to the count and omission of a large number of small farms. The 1935 average was lowered by the addition of many more small farms than had been omitted in 1930.[17] It must be remembered that each little farm of a few acres has the same weight in the average as each large farm.

Had the count of farms in 1930 and 1935 been upon a "normal" basis, the percentage of rented farms probably would have increased slightly instead of decreasing slightly.

Professor Davis's careful study of the Connecticut enumeration indicates that the number of cows in Connecticut in 1930 was affected about the same as was land in farms.[18] There are no important reasons for thinking that the 1935 count of cattle in Connecticut and elsewhere did not follow the pattern for land in farms. Other classes of livestock were similarly affected; and likewise the acreage of most crops.

There are other deficiencies of the census of agriculture which may be fully as important as the count of farms. All of these are somewhat related to the proportion of farms enumerated. But they probably depend more upon other types of changes. This article purposely confines itself to one aspect of the problem.

COUNTING THE FARMS IN 1940

Probably late in 1939 the Bureau of the Census will begin the counting of the farms in the United States as of the date of January 1, 1940. The nation cannot afford not to do the job better than it has ever been done before. The need is so great for knowing what is happening to farms in general and in hundreds of critical areas that a vigorous effort should be made to put this next counting of farms upon a full-enumeration basis and to see that the 1945 and later censuses follow the same lines. The writers of this article believe that enough has been learned from 1935 and earlier census experience to make such a full enumeration possible in 1940, or at least near enough to it so that the omissions will not be serious in most areas. The procedures needed appear to be as follows.

I. Have the enumerators report all agricultural production of any kind whatever anywhere, and then have the classifying done in the Bureau of the Census in Washington by trained editors who follow carefully stated rules, which should be published in the census reports, and followed exactly in later censuses. This procedure was begun in the 1935 census and needs only to be developed further and improved. It probably attained fully half of its objective at its first trial.

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[17] The count of farms of under 3 acres ran contrary to this; but the numbers of these were small at their most.

[18] This JOURNAL, Vol. 28, September, 1933, pp. 283–4.

The main reason for securing a full count is not the importance of the farms and production omitted, although this is considerable, but that the variations in proportion of farms and production reported from area to area and census to census, so long as the count is not full, make uncertain all measures of change and difference. We may not want even to classify as farms a million or two of the establishments reporting some agricultural production; but it is necessary that what are called farms in 1940 will also be called farms in 1945.

II. Requiring the enumerators to report agricultural production regardless of the occupation or occupations of the family or household. It may be necessary to use the full agricultural schedule for each establishment reporting any agricultural production.

III. Making trial enumerations, before the regular enumeration, of a few score sample townships in various sections of the country, and learning from these the defects in the proposed schedule and methods of enumeration, and the difficulties to be overcome.

IV. Conducting short training schools for prospective enumerators, and eliminating in advance those without needed ability or aptitude.

V. Having the enumerators locate and number all farms or rural households on a detailed road map, these to be put in the hands of the enumerators taking the following census: requiring succeeding enumerators to account for all farms of five years before and locate any new farms. The procedure has been discussed for some years, and in general is acceptable to census administrators. Forty counties were enumerated, experimentally, on this basis in 1935. The main obstacles have been that suitable base maps have not been available for considerable sections of the country (especially in the South), and the additional work imposed upon the enumerators. But by 1940 the Bureau of Public Roads will have maps showing location of roads and farmsteads for the whole United States. The additional work imposed upon the enumerators will be no more than required to take a good census without base maps. The saving of the present system is due only to the incompleteness of the enumeration.

There are special difficulties in taking the farm census among croppers in the South which these suggestions do not altogether meet and which the writers do not consider themselves competent to analyze adequately. This is also true of some relevant features of the general population enumeration. For example, it may be advisable to have secondary occupations reported for all households whether on farms or not; and principal occupations off the farm for members of farm households. We shall never have an adequate basis for estimating national income until income from domestic or household occupations is reported for urban as well as farm families. The so-called farm population count should be made only in connection with an enumeration that includes both agriculture and population; and the classification should be made in the office and not in the field.

In the sixty years since Francis Walker undertook to give us a real census of American industry and population, some highly important advances have been made. The census administrators time after time have responded to real needs of the current situation. But a point has been reached where a major change is called for; and it does not appear that those responsible for the 1940 census have become fully aware of the circumstances. The census administrators still speak in terms of the accuracy of the totals for the nation and by states. They do not seem to realize fully that today we must have county and even township data that can be used as basis of production adjustments, land use planning and several other related purposes. If the census does not supply us with these data, it will be supplanted, and very promptly too. The 1940 census represents probably the last chance it will have to prove its adequacy for the new needs. A very nearly full enumeration of farms of all description, with careful classification by types, that will give results comparable from census to census, is an absolute need of the times, and must be met even though it adds somewhat to the cost, and upsets considerably the routine of the job. If the present Administration is as much interested in good public management as is sometimes alleged, and as it occasionally demonstrates, it will not let the 1940 census fail for lack of an adequate appropriation.

DISCUSSION

No one will question the importance of securing the best possible count of the farms, farm people, and other aspects of the national agricultural picture. Our concern, therefore, must be with efforts to devise improvements in the procedures used. Dr. Black and Dr. Allen have presented a number of contentions which if well founded are of major importance both as indicating qualifications needed in the use of census data and as indicators to be considered in planning for future enumerations. Since they have specifically disclaimed the desirability of using their conclusions for setting up correction factors, our present concern is mainly with the implications of their studies in plans for the future. Improvement must depend upon critical analyses of past censuses together with attempts to identify and appraise factors which may affect the accuracy of future enumerations. The greatest handicap to such appraisal is, of course, that of making corrections in one faulty measure by reference to other faulty measures. Only rough indicators of the variations from an ideal count are available, and even these are such that opinions of qualified investigators will differ as to the dependence which should be placed upon them. So complex is the problem of defining farming, part-time farming, farmers, farm population, agricultural lands, etc., that even trained investigators differ in their results when surveying the same universes.[1] This fact should make us cautious in accepting as ideally perfect even so careful a survey as that made by Professor I. G. Davis in Connecticut, or that of Dr. Rozman in Massachusetts, and still more cautious about generalizing these conclusions to other parts of the United States. Despite these reservations, however, there seems very good evidence that the procedure in enumeration can and should be improved in future counts.

A number of the conclusions and recommendations presented by a subcommittee of the Social Science Research Council and the American Farm Economic Association are in line with the implications of this article as to possible methods of improvement.[2] These in the main have to do with a somewhat different organization of the field work in taking agricultural censues and would look to more use of the people who are working with the Division of Crop and Livestock Estimates in the Bureau of Agricultural Economics. There has been at times, however, a too easy conclusion that if the enumeration were carried out by some other agency or with the use of a different personnel in the Bureau of the Census, this would automatically bring about a far better result. It must be recognized that no method of organization will make available for a short period and at relatively low compensation an adequate number of trained investigators to take a census either of the agriculture or the population of the United States. Even with the best organization that can be developed practically it will still be necessary to use large numbers of people who have a less than satisfactory background of experience and training. In the 1930 Census there were 120,006 enumeration districts. These were included in some 575 supervisors' districts. Such an undertaking necessitates a large field staff which must be recruited in a comparatively short period, even though the greatest of freedom prevail in their selection, and even though the leadership be the best obtainable. If, as has been suggested, more of the personnel could be drawn from the Department of Agriculture's Crop and Livestock Reporters, from the State Statistician's offices, and from the agricultural colleges, it seems evident that better results could be obtained though many difficulties would still remain in getting as good a count as is desired. This comment is made not in deprecation of efforts to better the situation but merely in recognition of the human problems presented by the task regardless of where the enumeration is handled or by whom supervised. It seems clear that significant improvements can be made. The end result in any event, however, will be merely as close an approach to some ideal handling of the situation as can be secured practically.

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[1] Numerous instances could be cited in which trained investigators covering the same areas and seeking substantially similar information have secured significantly different results because of slight differences in formulation of questions, variations in coverage, etc. This merely illustrates the difficulty of finding any incontrovertible measure by which to gauge the adequacy or inadequacy of any given survey or enumeration.

[2] Report in press, to appear shortly as a bulletin of the Social Science Research Council.

Some notion of the variety of conditions which must be dealt with can be secured not only from the situation described for New England but from other peculiarly difficult areas as, for example, those of California. In a recent study by Dr. G. M. Peterson, of the Giannini Foundation, he found in San Diego County, California, some 3,000 farms listed.[3] His study showed about 4,000 properties of three acres and over outside city limits which were tax delinquent at the time of making the survey. Further investigation developed the fact that there were in SanDiego County alone approximately 16,000 tracts of three acres and over in individual ownership and outside city limits. Under census definition these would not be classed as farms unless a domicile of some kind had been constructed on them. The great majority of them are not farms in the sense that we ordinarily think of farms, even though they may have houses on them. They are in the main suburban homesites. The problem of drawing a clear distinction in such a situation is, of course, a very difficult one. In another area in central California large numbers of small tracts planted to fig trees and other fruits have been sold to individuals but are not operated by these individuals, at least in the early years of ownership. Operation is carried on by the selling company under contract with the owner. Many of these have incomes which would place them in the farming class in the minds of most people, yet it is very difficult to frame a definition which will differentiate individual farms under such conditions. A different but equally difficult situation is mentioned by Black and Allen, namely the problem of drawing a line between the Southern cropper and the hired laborer on the Southern plantation. Another type of problem which has given rise to difficulty in enumeration has come about as a result of depression conditions. Numerous farm properties were rented during properous times to operators who did not own them. Several of these might under these conditions appear as one farm, in the ordinary process of enumeration. With the onset of depression, however, many of these owners took up residence on such properties and became farm operators. These same enterprises then became not one farm but several farms under census definition. Hundreds of similar problems can be pointed out in nearly every section of the United States. These situations exemplify the inherent difficulty of arriving at a satisfactory basis for classifying farms and farm people. They point to the urgent need for further and very careful study of possibilities of more accurate definition.

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[3] From unpublished material dealing with rural tax delinquency in California.

In reading the discussion by Black and Allen one is impressed by the fact that we are after all dealing with these dynamic situations in which minor and major adjustments are continually occurring. There are some dangers in assuming that adjacent areas which appear superficially to be affected by the same sets of factors are actually being thus uniformly influenced. Very careful appraisals of the actual changes occurring are necessary if conclusions are to be depended upon. It seems probable that uniformity or nonuniformity in conditions of this kind have been more carefully appraised in such intimate studies as those made by Professor I. G. Davis, Dr. Rozman, and others, than any mere statistical approach to other areas in the country could provide.

Attention has been called from time to time to the danger in assuming that totals secured in response to given questions represent actual changes in the situation. This has been well illustrated in some of the questions on land utilization where we get, for example, large increases or decreases in such items as "woodland used for pasture" or "woodland not used for pasture." A similar danger exists, however, in assuming that the changes indicated actually did not occur. It is possible that some of the changes indicated for such states as Maine might be found explainable, in part, in terms other than inadequacy of coverage as implied in the analysis by Black and Allen. If the approach were made in terms of trying to find explanations for the changes indicated by census data, we might come out with a different set of conclusions than if we sought to explain the differences as being due to over- or undercoverage by enumerators. This is not meant to challenge the fact, seemingly fairly well established, that there has been significant variation in coverage in the last three or four census enumerations. It does seem possible, however, that a part of the variation shown actually did occur, perhaps even a larger part than Black and Allen have concluded, since we have been dealing with a very dynamic period in which many factors as yet not clearly recognized have been at work affecting the operations and residence of people in relation to farm lands. For example, it is easy to assume that if the farm operator works more than 150 days off the farm, the farm may be considered as a part-time farm. It will be found, however, that a substantial number of farm managers do work more than 150 days off the farm. Yet a farm large enough to have a hired manager is almost certain to be a rather substantial commercial enterprise. Many such situations are to be found in the Western and Southern states. Changes in employment conditions which would place given farmers in the class of more than 150 days or less than 150 days may easily have occurred during the past few years without affecting substantially the true classification of these individuals. For example, a man working at a given occupation may have had during 1928, 1929, and 1930 more than 150 days work off the farm. During the depression period this same man may have operated much as before but have had only 100 days work off the farm. Many others confronted with a decrease in the amount of available work off the farm have turned to larger production on the land controlled by them. These farms have changed in a certain intangible way but one which is extremely difficult to define.

One of the most mischievous features of the common usage of numbers of farms is in averaging, for all farms of the United States, production, farm income, etc., thus throwing into one general average the commercial farms of the country, together with hundreds of thousands of very small units which are much more in the nature of residences than of farms. Many of these are occupied by semi-retired people or people who have passed the period of active life; many are operated as side lines by people whose important source of income is from off the farm. If, then, these are included with the others in getting at average farm income, we get the same distortions that appear in averaging any group of exceedingly diverse items. It is possible that some more satisfactory definition or definitions can be devised under which farms that are clearly of small commercial importance will be designated in some separate category. As yet, however, no satisfactory differentiation along these lines has been devised. Much of the difficulty would, of course, be lessened if users of census data were more aware of the qualifications needed in computing averages and other generalized measures. The proposal made by Black and Allen that enumerators undertake to cover all enterprises which have any significant agricultural production and that carefully defined classifications be made of these by experienced census officials seems a very constructive suggestion. As pointed out in their article, some progress in this direction was made in the Census of 1935. There is need, however, for a better defining and publication of the bases on which such classifications are made.

The problem of enumeration presents two phases which are somewhat difficult to reconcile with each other. The first of these is a desire to get complete coverage. Certainly an enumeration which does not cover with substantial completeness the whole universe is unsatisfactory from almost any point of view. The other problem is that of maintaining comparability as between succeeding enumerations. This issue becomes a very important one at every census period when schedules are being prepared and plans for field organization are being shaped. Probably even more important than complete coverage is the requirement that the census enumerations indicate accurately the changes that are occurring. We are much more interested in the dynamics of the situation than in a completely accurate delineation of conditions as of a given time. For all properties which are clearly and generally accepted as being agricultural enterprises, this does not raise any question about the desirability of full coverage. It does present some difficulties with respect to complete inclusion, down to a very low minimum, of properties that are on the borderline as between mere residences and agricultural enterprises, at least if these are to be called farms and averaged in with the other farms of the nation. It is in this borderline group that great numbers of enterprises are so near the margin of being classed one way or the other that intensive efforts to secure complete coverage may result in serious difficulty of maintaining comparability even with relatively good enumeration procedure. Certain of the suggestions made by Black and Allen point to improvements which would help in clarifying definitions in these groups, particularly the proposal to take into account changes in general price level in using total value of product as a criterion. Even this, however, will not prevent entirely the inclusion in some censuses of given enterprises and the exclusion in other censuses of these same enterprises, thus damaging to some extent the comparability of the two counts.

It is evident that these problems should be thoroughly thrashed out prior to the Census of 1940 with a view to getting sufficient agreement both on procedure and definitions that these can be maintained virtually without change in succeeding enumerations. Only in such a way can comparability be established such that we shall have a reasonably adequate basis for recognizing the changes which actually occur. Even with the best procedure that can be devised in this connection it is probable that such aspects as changes in part-time farming and the significance of these in changing the sociological pattern of human endeavor will have to be based on special studies in given localities. Such definitions as have been mentioned above will inevitably have to be somewhat empirical and will be subject to difficulties through distortions which occur in applying them to widely different conditions. This appears to be an inevitable limitation of handling any classification on a national basis.

Despite such reservations as have been mentioned there seems reason to agree in the main with the conclusions drawn by the writers of this article. It seems probable that there were significant variations in the coverage in the 1925, 1930, and 1935 farm censuses. Steps taken to meet this difficulty in the 1935 Census appear to have been in the right direction, though not as yet carried far enough. There is substantial agreement on proposals I, II, III, and IV as indicated by these authors. With respct to V there is entire agreement about the desirability of more adequate mapping. Possibly other procedures may hold more promise than that indicated in this article. Very large areas of the United States are now being covered by aerial surveys conducted by a number of different agencies. There is considerable interest in standardization of aerial mapping, and this may be one of the most promising developments for securing more complete enumeration. It will not, however, meet all of the problem of dealing with borderline small farms especially in the vicinity of large cities.

One of the major defects in the present census procedure appears to be a lack of sufficient continuity in organization and personnel in the field staff. Proposals concerning this have been made by the subcommittee mentioned above. These or similar modifications of present organization and procedure would apparently help materially in securing a better count of the farms of the United States.

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Professor Benedict accepts the findings of our study except for three "reservations" as to the extent of error in existing census data; and the recommendations as to future census procedure except for supplementing them upon three points. The latter first. As to air mapping, we agree that it has been so developed in the last year or two as to prove a useful supplement to the base maps now being prepared by the Bureau of Public Roads, especially in the matter of enumerating land use. We chose to emphasize the Public Roads base maps because they alone permit a large advance in procedure, and they are likely to be everywhere available by 1940. It would be highly desirable if air mapping could accompany the 1940 census. It is highly probable that the 1950 census will include such mapping. The first census that includes such mapping will give data on land use that will not be closely comparable with those of any previous census. The nearer to such a procedure we can get in 1940, the nearer we will get to the desired goal.

As to selection of enumerators, it is perhaps not so important to use experienced workers now doing crop reporting and the like as Professor Benedict implies. The emphasis should be more upon selecting intelligent, fairly well educated persons as enumerators, training them for the specific job, and then using them in census after census, as would become more possible with more annual surveys and sample censuses. Such men will commonly be easier to train for the task than persons already experienced in crop reporting, survey taking, and the like, because they do not have so much to unlearn. The attitudes and objectives of crop reporters, for example, do not altogether fit the job of census taking.

Professor Benedict seems fearful that a complete coverage by the method we propose may affect the comparability of the results. We fail to see how this can be a serious problem as between future censuses, if the census officials devise proper principles and bases of classification to be applied to the schedules brought in. It is true that considerable variation will occur at the lowest margin of inclusion; but this will affect the data only for the bottom group, those for all the others being protected thereby.

Now as to the reservations about the findings. If our statements concerning Professor Davis's results seem to carry the implications that we accept them "as ideally perfect," this is merely a defect in exposition. In fact, we have compared Professor Davis's data with the census data town by town and census by census, until we have satisfied ourselves as to about what part of the deviations are due to differences in definition and what part to differences in enumeration. We might have included some of our own detailed analyses except for lack of space and except for not wanting to anticipate publication by Professor Davis. None of the enumerations is perfect, but our study leaves us with no doubt that Professor Davis's enumeration is more nearly correct.

As for other parts of New England, we of course agree that differences in conditions in adjoining towns can cause an increase in one and none or even a decrease in another. But this is not likely to be frequently the case, as would appear from our mapping of census changes. Furthermore, a great deal of detailed town-by-town analysis of changes in agriculture and land use, accompanied by no small amount of field observation, over the past seven years while we have been engaged in a study of the land and agricultural economy of New England, has given us a pattern of areas of uniformity of change according to topography, soil type and location with which the census reports of change are only partly consistent.

Professor Benedict suggests that the proper approach in studying this problem is to assume that the census reports of change are correct and to look for another explanation only when necessary. That, of course, is exactly what was done in this case. For three years the senior author struggled with the available census data upon New England agriculture and land use, trying to derive from them a consistent account and explanation of change, before deciding to inquire into the nature of the data and the census procedure. This led him into similar studies of change in relation to census data in other regions. The striking parallels found in other Northeastern states and in certain other sections reinforced his conclusions as to the New England census data. It is entirely possible, of course, that we have assigned too much of the change in reported data outside of the Northeast to variations in census procedure, and not enough to the "dynamics" of the period. We offer only a judgment on this point; but it is based upon more examination of census data in relation to other data, more consultation with other users of census data, and more interviews with research workers in different areas, than almost any judgment that has been made. Both of the authors have done considerable research work in some other sections of the country, notably the Great Lakes states and California.

Professor Benedict writes of the need of refined studies as a basis for the 1940 census. Indeed this would be desirable. The senior author has labored for three years to get such studies under way with the Social Science Research Council, with the Committee on Government Statistics and Information Services, and with the census officials themselves. And now the plans of the 1940 census are nearly complete. A tentative schedule has already been agreed upon among the Washington bureaucrats. The plans do not include the complete coverage of agricultural production urged in this article, and some other of the recommendations. Even Professor Benedict's innocent comments will unfortunately be used by census officials as reasons for not accepting these recommendations.

JOHN D. BLACK
R. H. ALLEN

VARIATIONS AMONG CITIES IN PER CAPITA INCOME

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Cities obviously differ in the per capita income of their residents. These differences are important in connection with many features of their public and private activities. This article will report methods of measuring, or at least estimating closely, the relative status of cities in the United States of 25,000 and over in respect of income at or near 1930 by using facts of record concerning 117 cities for 20 items of income or expenditure. It will also present certain facts concerning the significance of variations among cities in per capita income.

A true or perfect measure of the private income of a city is obviously the sum of the incomes of its citizens or inhabitants. This being impossible to obtain, one might use (a) the reported incomes of those reporting to the Federal government and (b) the wages (observed, taken from testimony, or estimated) for the rest. But the former are not revealed and the latter would require very great labor and expense for even rough estimates. So we can only estimate income from items which are related to income partially or deviously, and may be dependent upon other features of a city than the income of its residents.

This report suffers from four other limitations. It concerns dollar incomes with no allowance for differences in the value of money in the cities in question. It concerns, not absolute incomes in dollars per capita, but only relative incomes or indices which will rank the cities more or less accurately as their absolute per capita incomes would rank them if the latter were known. It concerns incomes for a period of several years centering about the year 1930. How stable the results are can be determined only when comparable data are again available, presumably in the next census. It concerns only 117 cities of the 310 which could have been used. They are, however, a fair sample for our problem.

What I have done is to take such facts as would presumably show a positive correlation with the true or perfect measures of the per capita income of the community or of some large group of its population, and treat them reasonably. The intercorrelations of these possible symptoms of income are themselves instructive.

The items below were chosen from about two hundred which I have collected for most cities of 25,000 or over. Some (e.g., number of income-tax returns) concern directly the incomes of the relatively wealthy; some (e.g., 5-percentile rental) concern the incomes of the very poor; some (e.g., wages of employees in retail stores) concern incomes of the so-called lower middle classes. From the many statistics of retail sales available those were chosen which seemed likely to correlate most closely with the expenditures of a city's residents.

Identification number *Item*

1. Approximate number of income-tax returns per capita. The number reported in U. S. Treasury Publication, No. 2108 for 1933, divided by the 1930 population.*
2. Approximate number of income-tax returns in 1926 reporting $5,000 or over. Computed pro rata from data for counties as given in *National Markets and National Advertising.*
3. Income as estimated in *Markets and Quotas*, Curtis Publishing Co., 1932, divided by the 1930 population to give a per capita estimate.
4. "Total income" as estimated for 1926 in *National Markets and National Advertising*, Advertising Department of the Crowell Publishing Co., 1927, divided by the geometric mean of the 1920 and 1930 populations.
5. "Marginal income" as estimated for 1926 (same source as Items 3 and 4) divided by the geometric mean of the 1920 and 1930 populations.
6. Average (with approximately equal weight) of the average salary of elementary-school teachers and the average salary of high-school teachers. Computed from data in the *Biennial Survey of Education*, 1928–1930, U. S. Department of the Interior, Office of Education, Vol. II, pp. 142 f. and 251 f.
7. Average salary of full-time employees in retail stores. *U. S. Census of Distribution for 1930*, Volumes 2 and 3.
8. Average wage of full-time employees in manufacturing plants. Average for 1929 and 1931. Computed from data in the supplements to the *1933 Biennial Census of Manufactures.*
9. Per capita bank deposits. Computed from data given in *Markets and Quotas*, Curtis Publishing Co., 1932.
10. Per capita expenditures for the support of churches in 1920. Computed from data in Tables 30 and 31 of *Religious Bodies, 1926*, U. S. Census.
11. Per capita value of sales of all retail stores. Computed from data in *U. S. Census of Distribution for 1930*, Volume 1.
12. Per capita value of sales of food. Same source as for Item 11.
13. Per capita value of sales of cigar stores. Same source as for Item 11.
14. Per capita value of sales of drug stores. Same source as for Item 11.

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* By inadvertence the income-tax scores for 1933 were used instead of those for the average of 1930 and 1931. Since the differences are small and "accidental" (the correlation between the two sets is .84) I did not recompute the correlations and indices. The changes would be very slight in the former and inappreciable in the latter

Identification number *Item*

15. Per capita circulation of fifteen leading magazines. The circulations are as reported in *Circulation of Fifteen Leading Magazines* by the Marketing Division of the International Magazine Company. The 1930 populations are used as divisors.
16. Per capita circulation (approximate) of Modern Screen, Radio Stars, and Modern Romances. Data from *Modern Magazines* for 1935 divided by 1930 population.
17. Per capita value of building permits for private garages. Computed from the data in Bulletin 545 of the U. S. Bureau of Labor Statistics, *Building Permits in the Principal Cities of the U. S. in 1930.*
18. Per capita number of automobiles. The sum of the numbers reported for Fords and cars other than Fords in *Markets and Quotas,* Curtis Publishing Co., 1932, divided by the 1930 population.
19. Estimated average family rental. Computed from data in the 1930 Census, *Statistics of Population,* Vol. 6, Tables 7 and 21 for each state.
20. Rarity of extreme poverty, measured by the rent paid (or equivalent if the home is owned) by the 5th percentile family (i.e., the rental less than which is paid by 5 per cent and more than which is paid by 95 per cent of the community's families). Same source as for Item 19.

Items 3, 4 and 5 are of unknown composition and may contain factors desirable from the advertiser's point of view, but not from ours. We shall in fact not use them in our final indices. Items 11, 12, 13 and 14, reporting the sales of retail stores in the city (total, food, cigar stores and drug stores) are disturbed by the fact that in suburban cities (such as Cambridge, Newton and Somerville), the residents buy much from the big city whose suburbs they are, and by the fact that in trading centers (such as Lexington, Kentucky, or the three Springfields), the retail stores sell much to non-residents. Item 9 (bank deposits) is subject to the same sort of disturbance.

Expenditures for churches (10) and for the fifteen well-known periodicals (15) indicate the incomes of church supporters and readers of "good" magazines. We lack items of expenditures for prostitutes, gambling, etc., as supplements and correctives. The expense for rental (Item 19) is also subject to moral limitations. A given expense for a home, say of $300 per year, may be a quarter of the income of men devoted to home and family or an eighth of the income of men devoted to more sensual and exciting pleasures.

The original data are marred for our purpose by certain inadequacies and defects. "Bank deposits" are a mixture of savings and check accounts; "Income-tax returns" are as described on page 18 f. of *Statistics of Income for 1930;* "Church expenditures" do not include all the churches in the city. These are the worst defects, but probably no item is impeccable. We can only hope that the errors act largely at random, so that a composite of many items will be fairly near the truth.

In certain cities the per capita income is a composite of incomes of white and negro families, and in all cities it is a composite of incomes of families heterogeneous in many respects. It would be useful to repeat this entire study with allowances for the age-distribution and other variables in each city.

It will be desirable eventually to study variation in income among special groups of cities, such as trading centers and suburbs, manufacturing, mining, and white-collar communities, north and south, large and small, etc. But it seemed best first to include a wide range of varieties, partly to have a large enough group to work with, and partly to gain information about the difficulties arising from heterogeneity. So I have used those cities which had populations of from 25,000 to 90,000 in 1900.[1] Some are now ten times as large as others; they are scattered all over the country; they include suburbs, trading centers, mining cities, etc. I did not even exclude Atlantic City, a resort-city in which the sales of cigar-stores, for example, would give an utterly fantastic measure of the income of the resident population.

Let us examine the facts regardless of all these disturbing factors except if, when, and as they influence some conclusion.

The first set of facts comprises the intercorrelations of the items shown in Table I. These are all computed by Sheppard's formula ($r = \cos \pi U$ where U is the percentage of unlike-signed pairs), counting cases of $+0$, $0+$, -0, $0-$, and 00 as follows: one fourth of them were counted as like-signed; one fourth of them were counted as unlike-signed; one half of them were divided between like-signed and unlike-signed in the same proportions as held for the pairs involving no zeros. This minimizes the influence of skewness and extreme cases in the distribution of any item.

I include also in Table I the correlations with a weighted composite of number of homes owned (per capita), persons graduating from high school in 1934 (per capita), ratio of the outside benevolences of the churches to their expenditures for their own preacher, choir, etc., and the excess of physicians, nurses and teachers over male domestic servants in the city's population. I shall call this composite score P.Q. since it seems to be an indication of certain personal qualities in the population. It will be of great service in interpreting expenditures as symptoms of income. Evidence which I lack space to present shows that the P.Q. of a city is only slightly related to its income or tax receipts, but rather closely related to how it spends each of these.

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[1] Less three for which 1930 data are not available, because they have been absorbed or are now too small.

Study of Table I shows that the items are more or less "constellated." The income-tax data and the commercial estimates of income correlate *inter se* from .57 to .81. If we leave out the Curtis estimate (Item 3) the other four correlate low with all other items, and not at all with P.Q.[2] The salary and wage data (Items 6, 7 and 8) correlate *inter se* .67, .56, and .66, and correlate low with bank deposits, church, magazines, total retail sales, and drugs, and low with P.Q. Ownership of automobiles (18), general magazines (15), and total retail sales (11) correlate *inter se* .71, .68, and .75, and very high with P.Q. (.65, .58, and .63). The average expenditure for rent and the expenditure of the 5-percentile family, intercorrelate .94, and correlate high (.58 to .66) with the salary and wage items, and low with P.Q. (.22).

TABLE 1

CORRELATIONS

The intercorrelations of various measures which are presumably indicative of the relative amounts of private income of cities; and the correlations of each measure with a composite (P.Q.) indicative of certain qualities in the population. *Decimal points are omitted.*

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	—	61	79	57	66	29	48	17	64	29	51	50	40	07	37	50	36	−03	38	37
2	61	—	62	75	81	19	34	08	24	47	34	23	14	28	36	43	34	04	52	49
3	79	62	—	58	59	56	61	55	43	51	64	52	36	14	50	44	54	25	17	59
4	57	75	58	—	71	18	27	19	32	67	39	32	10	12	36	32	29	16	53	49
5	66	81	59	71	—	39	46	04	53	45	08	43	19	−32	20	51	47	−25	64	73
6	29	19	56	18	39	—	67	69	33	−14	−01	39	17	−37	00	21	26	01	61	59
7	48	34	61	27	46	67	—	60	24	−08	28	63	42	−19	23	40	43	08	65	71
8	17	08	55	19	04	69	60	—	−09	01	38	41	50	13	40	17	38	50	66	58
9	64	24	43	32	53	33	24	−09	—	03	10	28	25	−30	13	36	08	−13	25	20
10	29	47	51	67	45	−14	−08	01	03	—	51	−10	−11	27	36	38	37	33	39	30
11	51	34	64	39	08	−01	28	38	10	51	—	43	38	48	75	45	31	68	36	21
12	50	23	52	32	43	39	63	41	28	−10	43	—	48	−19	24	36	38	06	54	48
13	40	14	36	10	19	17	42	50	25	−11	38	48	—	01	44	54	34	27	51	38
14	07	28	14	12	−32	−37	−19	13	−30	27	48	−19	01	—	44	−01	−07	42	−19	−29
15	37	36	50	36	20	00	23	40	13	36	75	24	44	44	—	32	21	71	37	13
16	50	43	44	32	51	21	40	17	36	38	45	36	54	−01	32	—	58	07	55	54
17	36	34	54	29	47	26	43	38	08	37	31	38	34	−07	21	58	—	14	71	69
18	−03	04	25	16	−25	01	08	50	−13	33	68	06	27	42	71	07	14	—	19	16
19	38	52	71	53	64	61	65	66	25	39	36	54	51	−19	37	55	71	19	—	94
20	37	49	59	49	73	59	71	58	20	30	21	48	38	−29	13	54	69	16	94	—
P.Q.	−10	−14	09	−06	−27	−07	13	25	−18	24	63	32	02	04	58	18	27	65	22	00

Since the commercial estimates are of undescribed constitution and may not be published in the future, it is best to get an income index without using them if that can be done with no substantial sacrifice. Guided by the facts of Table I we compute certain correlations between a composite of the three commercial estimates (3, 4, and 5 with respective weights of approximately 1, 2/3 and 1 respectively) and some of our other measures. The results (presented in column A of Table II), especially the correlation of .86 with an income-tax composite, show that we can dispense with them.

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[2] The Curtis estimate is weighted with whatever causes expenses for good magazines, and for rent, and has kinship with P.Q. These features may improve it for the purposes for which it was designed.

Since our expenditure items are already weighted in favor of reputable expenditures, we will do well to keep our index free of Items 15 (fifteen magazines), 11 (total retail sales), and 18 (automobiles) which all correlate high with P.Q.

Income-tax data we must, of course, keep, and the salary and wage data. To supplement these we need especially some items correlated with the incomes of the very poor. Item 20 (rental of the 5-percentile family) will serve this purpose, either by itself or as included in item 19 (average rental) in which it has suitable weight and with which it correlates .94. Sales of retail food-stores serves the same purpose, since so large a fraction of the incomes of the poor must be spent for food. Bank deposits, church expenditures and cigar and drug stores presumably deserve some weight.

Items 100 (Modern Screen, etc.) and 125 (private garages) are excluded because they are probably unnecessary and may not be available in future years.

A composite of Items 9, 10, 12, 13, and 14 (bank deposits, church support, and retail sales of food, cigar and drug stores) with weights of approximately 1, 1, 2/3, 2/5 and 2/5 respectively, has correlations as shown in Column D of Table II.

TABLE II

INTERCORRELATIONS OF VARIOUS COMPOSITE MEASURES

	A	B	C	D	E	F
A. Commercial estimates of income	—	.86	.41	.61	.71	−.10
B. Income tax returns	.86	—	.16	.52	.55	−.10
C. Salaries and wages	.41	.16	—	.15	.62	.17
D. Bank deposits, church, food, cigar and drug store sales	.61	.52	.15	—	.63	.13
E. Average rental	.71	.55	.62	.63	—	.22
F. P.Q. (home ownership, high school graduation, benevolence, etc.)	−.10	−.10	.17	.13	.22	—

I propose therefore as an index of the per capita private income of a city a composite of the following. For the weights I have used, any others that seem better can be substituted.

Item	*Weight*
1. The number of income tax returns	5
2. The number of income tax returns over $5,000	5
6. Average of average salary of elementary school teachers and average salary of high school teachers	2½
7. Average salary of full time employees of retail stores	2
8. Average wage of workers in manufacturing plants	3
9. Bank deposits	2½

Item	*Weight*
10. Current expenditures for churches	2
12. Sales of retail food stores	3½
13. Sales of retail cigar stores	1
14. Sales of retail drug stores	1
19. Average family rental (or equivalent in case of owned homes)	4

My weighting gives approximately equal weight to the income-tax data and the salary-wage data, and about 1 1/5 times as much to these together as to the data from expenditures and bank deposits. In the latter, rent and food store sales have about equal weight, and together as much as all the others.

That the resulting index has some value may be seen by noting which of the 117 cities it puts at the top and which at the bottom. By it the five highest are Newton, Atlantic City, Yonkers, Hartford, and Oakland. The five lowest are Augusta (Ga.), Charleston (S.C.), Montgomery, Savannah, and Kansas City (Kan.).

I report in Table III the score of each of the 117 cities so that anybody may check the index in any way that seems desirable. I report also the score of each city by two different combinations of Items, Index IB and Index IC. Index IB omits Items 7 and 8 but adds Item 20 (5-percentile rental) and Item 17 (building of private garages). The weights in Index IB are as follows: 1, 5; 2, 5; 6, 5; 9, 2½; 10, 3; 12, 3½; 13, 2; 14, 2; 17, 1½; 19, 5½; 20, 4. Index IC is the same as IB except that Items 13, 17, and 19 are omitted.

It will be observed that these substantial changes in the elements do not greatly alter the ranking of the cities. The correlations between the three indices are: I_A with I_B, .93; I_A with I_C, .88; I_B with I_C, .98.

An accurate census of the actual incomes of the residents of fifty or more selected cities would test the validity of these scores. If they are found valuable, this same census (or a more extensive one) could be used to compute absolute dollar incomes from the relative scores by this index. It is at least good enough to make its correlations instructive. Some of them are as follows:

I. With the per capita value of property subject to taxation in these cities (computed by using the reported assessed valuation and reported rate of assessed to real value for each city in 1930) $r=.44$.

II. With the "personal qualities" composite of scores for home owning, graduation from high school, ratio of outside benevolences to expenditures for local churches, and excess of physicians, nurses and teachers over male domestic servants, $r=.08$.

III. With a composite of the per capita numbers of telephones and of domestic installations of gas and of electricity, $r=.37$. The correlation of the "personal qualities" composite with the gas, electricity, and telephone composite is .57. Since the correlation of I with the "personal qualities" composite is only .08, we can conclude that the frequency of use of gas, electricity, and telephones in a city is a better index of its populace than of their per capita income, and is a poor index of the latter.

TABLE III

SCORES OF CITIES IN PER CAPITA INCOME BY THREE INDICES

	A	B	C
Alabama			
Birmingham	−5	−8	−3
Mobile	−10	−11	−5
Montgomery	−11	−12	−6
Arkansas			
Little Rock	−5	−6	−2
California			
Oakland	10	10	8
Sacramento	8	6	6
Colorado			
Pueblo	−9	−13	−9
Connecticut			
Bridgeport	2	1	2
Hartford	14	15	14
New Britain	0	−2	−2
Waterbury	3	2	2
Delaware			
Wilmington	8	10	7
Florida			
Jacksonville	−5	−5	−1
Georgia			
Atlanta	−2	−2	−2
Augusta	−15	−15	−9
Savannah	−11	−10	−5
Illinois			
East St. Louis	−5	−8	−5
Joliet	9	9	6
Peoria	0	2	3
Quincy	−6	−5	−2
Rockford	2	2	−1
Springfield	0	0	1
Indiana			
Evansville	−7	−8	−4
Fort Wayne	2	3	3
South Bend	1	1	0
Terre Haute	−4	−5	−2
Iowa			
Cedar Rapids	−2	−2	−1
Council Bluffs	−6	−10	−6
Davenport	0	0	1
Des Moines	1	0	3
Dubuque	−5	−5	−3
Sioux City	−3	−4	−2
Kansas			
Kansas City	−10	−13	−7
Topeka	0	−2	0
Kentucky			
Covington	0	−3	−2
Lexington	4	2	3
Maine			
Portland	4	4	4
Massachusetts			
Brockton	1	0	1
Cambridge	9	9	7
Chelsea	−4	−5	−3
Fitchburg	−3	−3	0
Haverhill	−2	4	−1
Holyoke	2	3	3
Lawrence	−3	−4	−1
Lynn	3	4	3
Malden	2	4	4
New Bedford	−6	−5	−3
Newton	31	37	28
Salem	3	4	4
Somerville	5	3	3
Springfield	7	7	6
Taunton	−7	−8	−6
Michigan			
Bay City	−8	−9	−5
Grand Rapids	6	7	5
Jackson	0	0	0
Saginaw	−2	−5	−3
Minnesota			
Duluth	−1	−2	0
Missouri			
Joplin	−8	−12	−7
Montana			
Butte	5	−3	−1
Nebraska			
Lincoln	0	−1	0
N. H.			
Manchester	−6	−7	−4
N. J.			
Atlantic City	19	25	17
Bayonne	2	1	2
Camden	−4	−4	−2
Elisabeth	3	0	−3
Hoboken	9	9	8
Passaic	3	2	−1
Trenton	5	6	6
N. Y.			
Auburn	0	1	1
Binghamton	2	4	3
Elmira	3	2	2
Schenectady	7	8	5
Troy	1	1	2
Utica	3	4	4
Yonkers	18	20	13
Ohio			
Akron	−5	−1	−2
Canton	6	4	1
Dayton	3	−2	3
Springfield	−4	−6	−5
Youngstown	1	−2	−1
Oregon			
Portland	2	1	2
Pennsylvania			
Allentown	2	5	1
Altoona	−4	1	2
Chester	1	−1	0
Easton	9	9	7
Erie	1	1	1
Harrisburg	4	6	6
Johnstown	−1	−3	−2
Lancaster	3	5	6
McKeesport	5	6	3
Newcastle	−2	−1	0
Reading	2	3	2
Wilkes-Barre	2	3	3
Williamsport	1	2	3
York	1	3	5
R. I.			
Pawtucket	−2	0	0
Woonsocket	−3	−3	−2
S. Carolina			
Charleston	−12	−12	−5
Tenn.			
Chattanooga	−5	−6	−2
Knoxville	−7	−7	−2
Nashville	−4	−6	−2
Texas			
Dallas	4	3	6
Fort Worth	−4	−5	−2
Galveston	−1	−2	1
Houston	3	2	4
San Antonio	−7	−8	−3
Utah			
Salt Lake City	−1	−4	0
Virginia			
Norfolk	−5	−6	−3
Richmond	1	1	3
Washington			
Seattle	7	5	6
Spokane	−2	−5	−1
Tacoma	−3	−5	−2
W. Va.			
Wheeling	8	7	8
Wisconsin			
La Crosse	−3	−4	−2
Oshkosh	−4	−2	−1
Racine	3	3	−1
Superior	−6	−7	−4

IV. With the percentage of persons 16 or 17 years of age attending schools, $r = -.13$.

V. With a composite of per capita public expenditures in 1930 for teachers' salaries, textbooks and supplies, libraries and museums and recreation, $r = .52$.

VI. With a composite of per capita public expenditures for highways, light, sanitation, general government, police, fire department, health and public safety, $r = .43$.

The correlations of the "personal qualities" composite with the items of IV, V, and VI are very different from those of I. They are .56, .24, and −.33. The −.13 and .56 for IV offer impressive evidence of the fact that the way the citizens spend their income counts more in certain important matters than the amount they have to spend. The .52 and .24 for V in conjunction with the .43 and −.33 for VI are further evidence of this, complicated, however, by possible influence of the cost of living.

It would be possible to compute correlations showing the significance of differences between cities in private income for many other features of the cities in question. But it seems best to defer this until the facts presented in the paper have been supplemented by data from all cities of 25,000 or over, and until the correlations have been computed for less heterogeneous groups of cities.

OUTLINE OF 1936 MORTALITY AND NATALITY TABULATIONS MADE BY THE BUREAU OF THE CENSUS

By Forrest E. Linder
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The principal vital statistics tabulations made by the Bureau of the Census are published annually in *Mortality Statistics; Birth, Stillbirth, and Infant Mortality Statistics;* or in *Vital Statistics—Special Reports.* These published tables are consolidations and condensations of more detailed, printed machine tabulations. The unpublished data constitute a valuable source of material which is available to the serious student of vital statistics. Files in the Division of Vital Statistics contain voluminous unpublished mortality tabulations dating back to 1900, and natality tabulations dating back to 1915. While the Bureau of the Census cannot supply unlimited compilations from these files, every possible effort is made to meet the needs of those desiring such material. With the ultimate extension of microphotographic methods of preserving data, it may be possible to supply film copies of complete sets of tabulations at a nominal cost.

One of the principal obstacles to the full utilization of such extensive statistical material collected by various governmental agencies, is the fact that the nature and extent of such data is not well known to those outside each particular collecting agency. The desirability of detailed indices which would facilitate the use of such material cannot be overemphasized. The outlines given here are intended to summarize the specifications for each of the machine tabulations now being made by the Bureau of the Census of 1936 mortality and natality data.

All vital statistics tabulations by the Bureau of the Census are based on birth and death certificates, transcripts of which are obtained from the various state and city public health offices where the original certificates are permanently filed. In 1936 the Bureau received transcripts for approximately 1,475,000 deaths, 2,136,000 births, and 74,000 stillbirths. Each of these individual records is put through a series of coding processes whereby the written information is translated into numerical codes. This coded information is then transferred to a standard 45-column tabulation punch card. Detailed instructions regulating all coding and punching procedures are given in the official 1936 *Instruction Manual* prepared by the Division of Vital Statistics. A limited number of *Instruction Manuals* are still available for free distribution to professional persons.

Figures 1 and 2 are reproductions of the 1936 mortality and natality cards. Below each card is a brief description of the information punched in the various fields. Machine tabulations from these cards are made, not on commercial tabulating machines, but on the census "unit counter" machine. A description of these machines, as used in the 1930 Population Census, has been published by Dr. Leon E. Truesdell.[1] The unit counter does not, like the commercial machine, add up amounts represented by holes punched in the cards, but rather counts the number of instances (in this case births or deaths) for specified classifications, for example, the number of deaths of males under five years of age. A clear understanding of the nature of the resulting tabulations can be had by considering the tabulation to be composed of two parts. The first part may be termed the "sort" and the second part the "machine count." The cards are first divided into a number of groups by a sorting machine. Each group is then run through the unit counter and the number of instances in specified classifications is counted and recorded.

The printed record of the tabulation is made on standard census machine slips. These machine slips are printed forms of three to six "decks," each deck consisting of 10 columns of tabulation. The groups into which the cards have been sorted are indicated on the stub of the first deck, whereas the column headings show the calssifications for which counts are made. The following decks may be considered as horizontal extensions of the first deck, since they contain only additional columns of machine counts. Figure 3 is a reproduction of one machine slip for Mortality Tabulation No. 2. This reproduction shows the first deck and the column headings for the remaining decks. The "sort" and consequently the detail of the side stub is the same for all decks.

The birth and death transcripts and the tabulation punch cards used in making the tabulations are not preserved, but the printed machine slips are permanently filed.

The tables given on pages 486 and 487, outlining the 1936 vital statistics tabulations, give three specifications for each tabulation: (a) the cards included; (b) the sorting groups; and (c) the classifications for which the counts are made.

In a sort of cards on the basis of two items, one sort is a sub-division or breakdown of the other. For example, if it is stated that the cards are sorted into "cause of death; sex," this means that the sex distinc-

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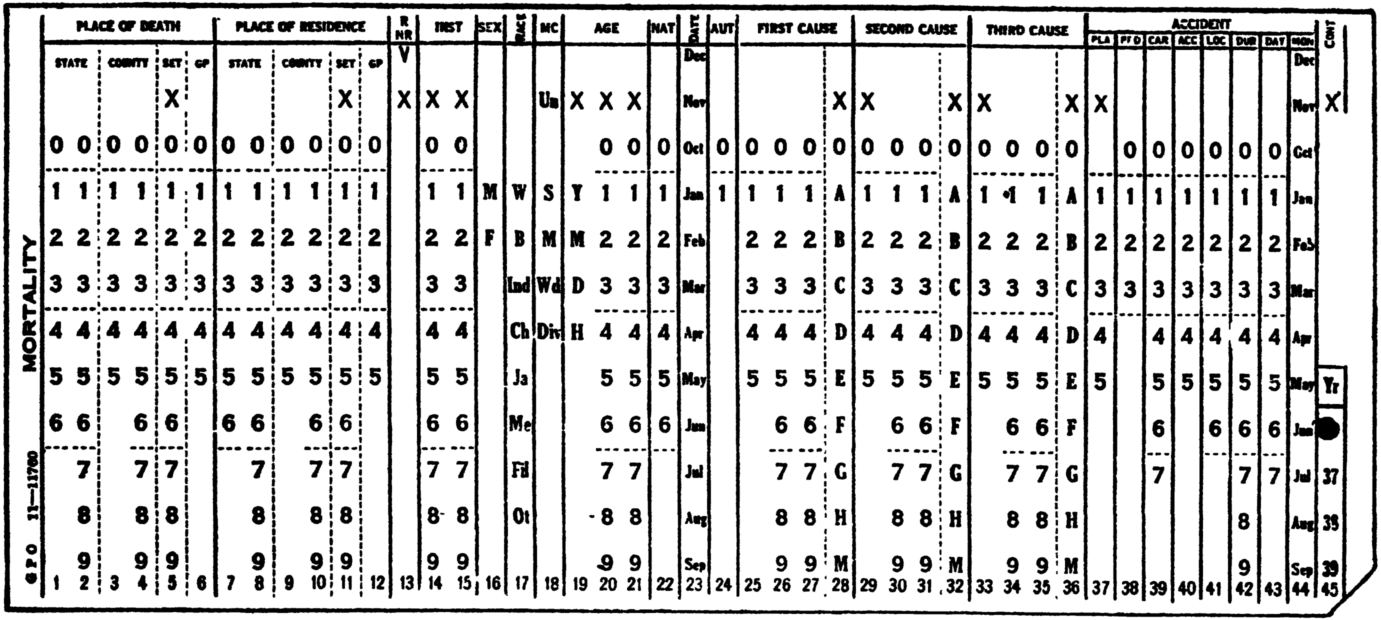
[1] Truesdell, Leon E. "The Mechanics of the Tabulation of the Population Census," This JOURNAL, March 1935, Volume 30, pp. 89–94.

FIGURE 1

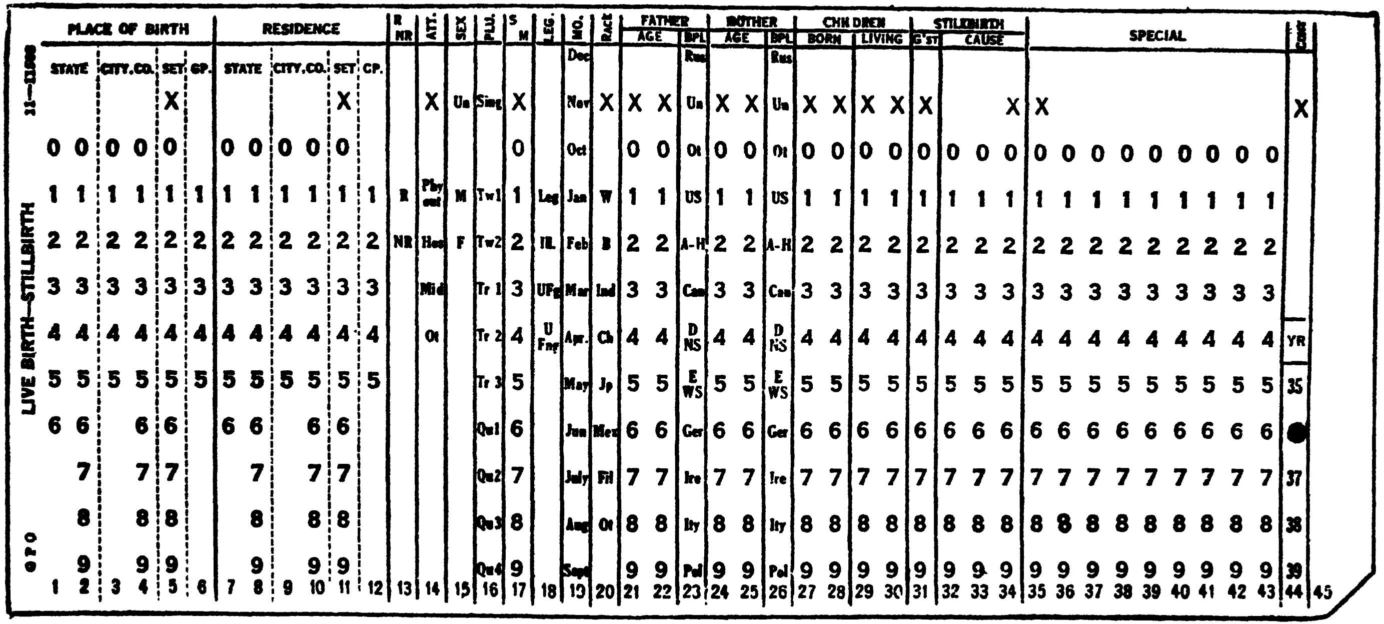
CENSUS MORTALITY CARD—1936



Information punched on mortality card: columns 1–6, place of death; columns 7–12, place of residence; column 13, resident or nonresident of place of death; column 14, type of hospital or institution in which death occurred; column 15, type of ownership of institution in which death occurred; column 16, sex; column 17, race; column 18, marital condition; columns 19–21, age (the code in column 19, years, months, days, hours, determines the meaning of the numerical code in columns 20, 21); column 22, brief code giving nativity of decedent and parents of decedent; column 23, month; column 24, autopsy, yes or no; columns 25–28, primary cause of death; columns 29–32, secondary cause of death; columns 33–36, tertiary cause of death (all cause of death codes according to detailed International List and selected by Joint Cause Manual); columns 38–44, additional data for motor vehicle accidents relating to place of accident, type of decedent (pedestrian or occupant), type of motor vehicle, nature of accident, location of accident, duration of injury, day of week on which accident occurred, month of accident; column 45, control for reproducing machine and year.

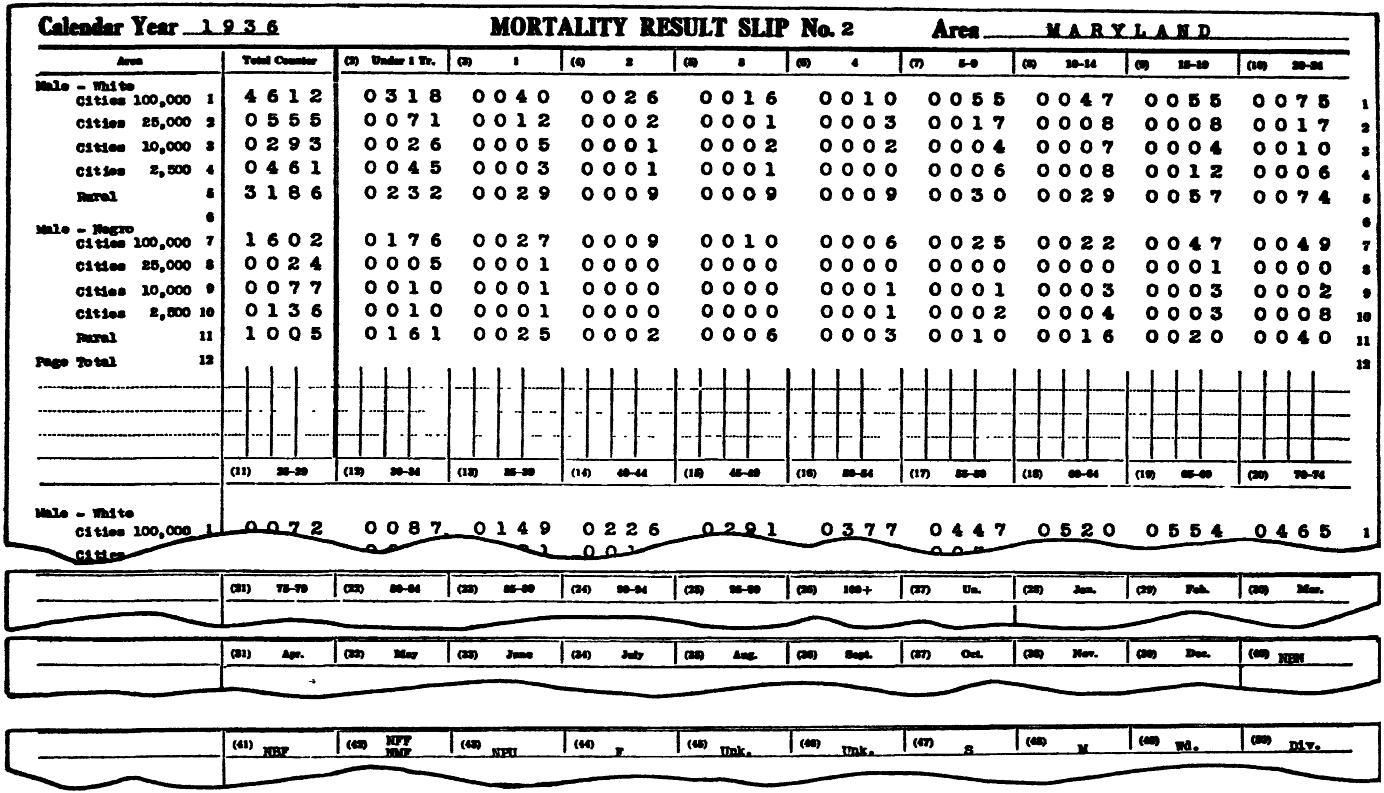
FIGURE 2

CENSUS NATALITY CARD—1936



Information punched on natality card: columns 1–6, place of birth; columns 7–12, place of mother's residence; column 13, mother, resident or nonresident of place of birth; column 14, attendant at birth; column 15, sex (unknown only if stillbirth); column 16, single or plural birth, number living if twins, triplets, etc.; column 17, sex of mates if plural birth; column 18, legitimacy; column 19, month; column 20, race; columns 21, 22, age of father; column 23, country of birth of father; columns 24, 25, age of mother; column 26, country of birth of mother; columns 27, 28, number of children born; columns 29, 30, number of children living; column 31, period of gestation for stillbirths; column 32–34, cause of stillbirth; columns 35–43, special field not used in 1936; column 44, control for reproducing machine and year.

FIGURE 3—CENSUS MACHINE SLIP FOR MORTALITY TABULATION NO. 2—1936



Calendar Year 1 9 3 6 **MORTALITY RESULT SLIP No. 2** **Area** M A R Y L A N D

Area		Total Counter	(2) Under 1 Yr.	(3) 1	(4) 2	(5) 3	(6) 4	(7) 5-9	(8) 10-14	(9) 15-19	(10) 20-24	
Male - White Cities 100,000	1	4612	0318	0040	0026	0016	0010	0055	0047	0055	0075	1
Cities 25,000	2	0555	0071	0012	0002	0001	0003	0017	0008	0008	0017	2
Cities 10,000	3	0293	0026	0005	0001	0002	0002	0004	0007	0004	0010	3
Cities 2,500	4	0461	0045	0003	0001	0001	0000	0006	0008	0012	0006	4
Rural	5	3186	0232	0029	0009	0009	0009	0030	0029	0057	0074	5
	6											6
Male - Negro Cities 100,000	7	1602	0176	0027	0009	0010	0006	0025	0022	0047	0049	7
Cities 25,000	8	0024	0005	0001	0000	0000	0000	0000	0000	0001	0000	8
Cities 10,000	9	0077	0010	0001	0000	0000	0001	0001	0003	0003	0002	9
Cities 2,500	10	0136	0010	0001	0000	0000	0001	0002	0004	0003	0008	10
Rural	11	1005	0161	0025	0002	0006	0003	0010	0016	0020	0040	11
Page Total	12											12

Area		(11) 25-29	(12) 30-34	(13) 35-39	(14) 40-44	(15) 45-49	(16) 50-54	(17) 55-59	(18) 60-64	(19) 65-69	(20) 70-74	
Male - White Cities 100,000	1	0072	0087	0149	0226	0291	0377	0447	0520	0554	0465	1
Cities												

(21) 75-79	(22) 80-84	(23) 85-89	(24) 90-94	(25) 95-99	(26) 100+	(27) Un.	(28) Jan.	(29) Feb.	(30) Mar.

(31) Apr.	(32) May	(33) June	(34) July	(35) Aug.	(36) Sept.	(37) Oct.	(38) Nov.	(39) Dec.	(40) NBM

(41) NBF	(42) NFF NMF	(43) NPU	(44) F	(45) Unk.	(46) Unk.	(47) S	(48) M	(49) Wd.	(50) Div.

The reproduction shows the first "deck" with sorted groups indicated in the stub and counted items shown on the column heads. Column heads only are shown for the remaining decks since all stubs are identical.

tion is shown for each cause of death. But in the machine count, while each item is a breakdown of each item sorted, the items counted are usually parallel classifications and not successive breakdowns one of the other.

An example may serve to make this clear. Consider Mortality Tabulation No. 2. This tabulation is based on all mortality cards. These cards are first sorted into state groups. Each state group is sorted by sex; each state-sex group by race; and finally, each state-sex-race group is sorted on the basis of the population of the place of death. Then each of these state-sex-race-population groups is run through the unit counter, and counted by age, month of death, nativity, and marital status. The distribution by age is therefore available for each state-sex-race-population group, and so also is the distribution by month of death, by nativity, and by marital status. But the distribution by month of death is not available for age groups, nor is the distribution by nativity available for month-of-death groups.

Most tabulations involving geographic areas give the number of births or deaths according to the city or county in which the birth or death occurred. The exceptions to this are Mortality No. 12, in which the geographic areas are those of the place of residence of the decedent, and Natality No. 5, in which the geographic areas refer to the mother's residence.

Certain of the tabulations contain a classification based on the population of place of birth or death. This classification consists of the following groups: (a) rural part of counties, which includes everything outside of cities or incorporated places having more than 2,500 inhabitants; (b) cities or incorporated places of 2,500 to 10,000 population, designated as "rural cities"; (c) cities of 10,000 to 25,000; (d) cities of 25,000 to 100,000; (e) cities of 100,000 or more. This five-group classification is not used in all cases and, where the terms "Urban" and "Rural" are used alone, the "Rural" includes all areas under 10,000 population and the "Urban" all cities of 10,000 or more population.

Where the expression "detailed races" is used, the racial breakdown is in detail as punched in column 17 of the mortality card, except that positions 7 and 8 are thrown together. Where race is stated without qualification, the racial breakdown is White, Negro, and Other, or simply White and Other.

In addition to the tabulations outlined here, certain experimental tabulations will be made. Some of these will form the basis for more extensive and adequate state reports. Other rather extensive tabulations will be made, in order to obtain material for analysis of multiple

CENSUS MORTALITY TABULATIONS—1936

For each tabulation, items under "sorting specifications" are successive breakdowns, whereas items under "counting specifications" are breakdowns of each sorted group, but not successive breakdowns under each other. In all instances, the data tabulated are the number of deaths (exclusive of stillbirths) for each classification.

Tab.	*Cards included*	*Sorting specifications*	*Counting specifications*
1	Cards for cities of 10,000 or more population.	Each state; each city; sex; race for certain cities.	Five-year-age groups; month; detailed race; nativity of white.
2	All cards.	Each state; sex; detailed race; population of place of death.	Five-year-age groups; month; nativity; marital condition.
3	All cards.	Each state; detailed cause of death; sex.	Population of place of death by race; individual cities over 100,000 by race.
4	All cards.	Each state; race for selected states; detailed causes of death; sex.	Five-year-age groups; month; autopsy; secondary cause (yes or no); tertiary cause (yes or no); type of institution.
5	Cards for cities of 10,000 to 100,000 population.	Each state; race for selected states; selected causes of death; sex.	Each city.
6	Cards for areas under 10,000 population.	Each state; race for selected states; selected causes of death; sex.	Each county.
7	Cards for cities of 100,000 or more population.	Each state; each city; race for selected cities; selected causes of death; sex.	Five-year-age groups; month
8	All cards for violent or accidental deaths.	Each state; type of accident; place of accident.	Five-year-age groups.
9	All cards for motor-vehicle accident deaths.	Each state; type of accident; rural; rural city; each city over 10,000 population.	Type of pedestrian, vehicle, accident; location of accident; duration of injury; day and month of injury.
10	All cards.	Each state; urban and rural groups; type of institution where death occurred.	Each city and county
11	Cards for nonresident deaths.	Each state; urban and rural groups; type of institution where death occurred.	Each city and county
12	Cards for nonresident deaths.	Each state of residence; urban and rural groups; type of institution where death occurred.	Place of residence; each city and county.
13	Cards for deaths under one year of age.	Each state; urban and rural groups; race.	Each city and county
14	Cards for deaths under one year of age.	Each state; race; selected causes of death; detailed age groups; sex.	Population of place of death; individual city.
15	Cards for deaths under one year of age.	Total U. S.; cause of death; detailed age groups; sex.	Detailed race; month.
16	All cards except White or Mexican.	States of 1920, all others; Negro, other races; detailed causes of death; sex.	Five-year-age groups; month; detailed race.

CENSUS NATALITY TABULATIONS—1936

For each tabulation, items under "sorting specifications" are successive breakdowns, whereas items under "counting specifications" are breakdowns of each sorted group, but not successive breakdowns under each other. In all instances, the data tabulated are the number of live births for each classification.

Tab.	*Cards included*	*Sorting specifications*	*Counting specifications*
1	All cards.	Each state; rural, rural cities, each city over 10,000 population; sex.	Detailed race of child; parent nativity of White; month; nativity of father of White; nativity of mother of White; legitimacy by race.
2	All cards for plural births.	Each state; twin, triplet, etc., by number living; race; White by nativity of mother; age of mother in 5-year-age groups.	Age of father; number of children born; sex of mate; country of birth of mother.
3	All cards.	Each state; urban and rural groups; race; attendant at birth.	Each city and county.
4	Cards for nonresident births.	Each state; urban and rural groups; race; attendant at birth.	Each city and county.
5	Cards for nonresident births	Each state of residence; race; attendant at birth.	Place of residence, each city and county.
6	All cards.	Each state; sex; race; country of birth of White mother; age of mother in 5-year-age groups	Age of father; country of birth of father; number of children born; legitimacy by urban or rural.
7	All cards except those for Massachusetts and New Hampshire.	Race; country of birth of White mother; birth order of child; age of mother in 10-year-age groups	Unit of age of mother; number of children living.

CENSUS STILLBIRTH TABULATIONS—1936

For each tabulation, items under "sorting specifications" are successive breakdowns, whereas items under "counting specifications" are breakdowns of each sorted group, but not successive breakdowns under each other. In all instances, the data tabulated are the number of stillbirths for each classification.

Tab.	*Cards included*	*Sorting specifications*	*Counting specifications*
1	All stillbirth cards.	Each state; rural, rural cities, cities of 10,000 to 100,000 as a group, each city of 100,000 or more population; sex.	Detailed race of child; parent nativity of White; month; nativity of father of White; nativity of mother of White; legitimacy by race.
2	All stillbirth cards.	Each state; urban, rural groups; race.	Each city and county
3	Cards for plural stillbirths.	Each state; twins, triplets, quadruplets; race; age of mother in 5-year-age groups.	Age of father; number of children born; sex of mate; country of birth of White mother.
4	All stillbirth cards.	Total U. S. except Massachusetts (Massachusetts separately); sex; race; White by country of birth of mother; age of mother in 5-year-age groups.	Age of father; country of birth of father; number of children born; legitimacy by urban or rural.

causes of death. Specifications for these machine tabulations are not yet available.

The 1936 tabulations are designed to provide tables which are comparable in form with those published in recent years and to provide, in addition, new material relating to modern social and medical interests. A fundamental problem in any statistical agency, such as the Bureau of the Census, is to keep its classifications static enough to show time trends and, at the same time, to make such revisions as are needed. Needless to say, the nature and extent of mortality and natality tabulations have changed frequently since the Division of Vital Statistics was first established. The outlines given here are descriptive only of the 1936 tabulations. Future revisions are contemplated, which will omit certain data of little social or medical importance, and add more valuable information.

ON AN ATTEMPT TO REDUCE INFANT MORTALITY IN DENMARK

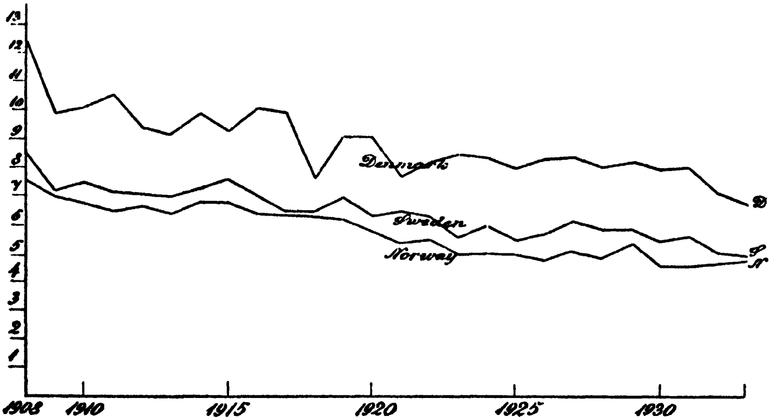
By Hans Cl. Nybølle
University of Copenhagen

I

Of the Scandinavian countries, Norway, Sweden and Denmark, the last-mentioned holds a rather bad record as far as infant mortality is concerned, and this has been the case for many years, even after statistics began to show a declining movement in all the three countries.

In order to obtain a survey of the respective levels in the three countries we may construct an index of the variations from year to year by computing in the ordinary and well-known way the ratio between the number of deaths occurring during a calendar-year among babies having not yet passed their first year and the number of children born alive during the same year. Of course this method cannot be entirely exact, because in actual fact the number of deaths does not wholly originate from the number of births of the same year, but partly from births during the preceding year. However, merely for the purpose of obtaining a survey the present method should suffice.

FIGURE 1
INFANT MORTALITY IN THE SCANDINAVIAN COUNTRIES 1908–1933



In the diagram (Figure 1) the upward and downward movement of infant mortality during the greater part of the present century has been illustrated for each of the three countries. As will be seen the mortality has fluctuated rather considerably; but in spite of these irregularities the movements must be interpreted mainly as declining. Further, the courses of the three curves show marked parallelism, which undoubtedly puts Denmark in a rather unfortunate position, not particularly because the Danish curve is the upper one, but mainly because this curve invariably runs at a remarkably higher level than the other two curves.

For the last 10 years alone we quote the following indices (percentages):

	Norway	Sweden	Denmark
1924	5.0	6.0	8.4
1925	5.0	5.5	8.0
1926	4.8	5.6	8.4
1927	5.1	6.0	8.3
1928	4.9	5.9	8.1
1929	5.4	5.9	8.3
1930	4.6	5.5	8.0
1931	4.6	5.7	8.1
1932	4.7	5.1	7.2
1933	4.8	5.0	6.8

On an average the infant mortality of Norway and Sweden was 5.3 per cent during these years, while the corresponding figure for Denmark was 8.0 per cent. This means that the infant mortality of Norway and Sweden is only two-thirds of that of Denmark, and it should be noted, that even if we took the numbers of still-born children into account, the result would not differ.

A good deal of time has been spent in studying the causes of this phenomenon, which has puzzled medical as well as statistical science.[1] Several physicians have conducted propaganda campaigns to institute measures against certain supposed causes.

The Health Committee of The League of Nations has devoted its attention to the problem and it has been dealt with at an official nordic statistical conference, etc. No wonder that the National Health Service of Denmark in 1929 most willingly accepted a generous offer from the Rockefeller Foundation of a financial contribution towards a practical attempt at reducing the high infant mortality of the country on condition that the Danish authorities would undertake to follow the matter up if the attempt should appear to be successful.

In order to carry out this experiment three districts were selected, one of which for special reasons was chosen within the capital of

[1] *Cf.* H. Cl. Nybølle: "Infant mortality in the northern countries," *Nordic Statistical Journal*, vol. 3, Stockholm 1931, p. 311. Read before the official conference (Helsingfors 1931) of the chiefs of the state statistical bureaus of the nordic countries.

Copenhagen; the two others, on the other hand, were chosen in the rural districts, one of them in the insular part of the country, the other in Jutland (the Holbæk and Vejle districts respectively). Then three excellently trained nurses—one for each district—were charged with the task of approaching all mothers who in each of the districts had recently given birth to children, immediately offering them gratuitously all their experience of child-nursing; and moreover, during the first year of each child, regular periodical visits in order to advise and help the mother also gratuitously. By special agreement the nurses received communications from the official birth-registers about births occurring in their districts.

For each child under nurse-control the nurse had to keep a diary gradually supplied with facts which might be of interest for a judgment of the hygienic and social conditions of the "life" under consideration. These diaries contain a large number of records well worth a closer study. Here we only make use of those that concern the computation of the mortality (cf. below).

II

What would be the effect of these measures could not possibly be ascertained if other measures were not taken with the object of showing the mortality among a group of children under essentially identical conditions, but not influenced by the efforts of the nurses. For this purpose there was, of course, the current records of the official statistics. For several reasons, however, the utilization of this possibility was found less apposite in this connection. The registrations of births and deaths take place in the districts where these actually occur and, even in cases of the decease of babies, independently of each other. This drawback does not matter when experiences from the country as a whole are utilized for computing infant mortality; for then it is only migrations between Denmark and other countries which may disturb the calculations, and these migrations may ordinarily be considered trifling so far as babies are concerned. If on the other hand we purposely confined ourselves studying the mortality within a limited home-district, for instance so limited that the conditions must closely resemble those of the nurse-districts, we could not ignore migrations to and from the district (cf. below).

In order to procure more reliable observations special measures therefore must be taken. The possibilities for such, however, existed. For besides the legal registrations of births and deaths (ordinarily undertaken by the clergy) Denmark has a coordinated registration of the population settled in each local district, undertaken by the local authorities. In addition to births and deaths the population-registers record the movements of the inhabitants. Now, suitable districts (in the following called "control-districts") in the neighbourhood of the nurse-districts were chosen and, as far as the rural districts are concerned, the Danish State Statistical Department was charged with collecting records from the said population-registers of the control-districts, records suitable for a more exact ascertainment of the infant mortality of the control-districts. For each child reported to the register as being born alive in the district, but not for children reported as to have immigrated into the district, the Department, according to an arrangement made for this purpose, received a special report; if the child in question died or moved away from the district before having reached exactly the age of one year the report was given when the child departed; if the child reached its first birthday while living in the district the report was given when this fact had been stated.

The reports were in other respects the plainest possible. They only stated the name, profession, and place of residence of the parents, the day and year of the mother's and the child's birth, the sex and legitimacy of the child, and finally, either the time at which the child had departed (died or moved away) or, in the opposite case, a direct notice of the anniversary. If any changes reported to the register had occurred as to the conditions of the child (if the parents married or the child was put out to nurse, etc.) such incidents were noticed too.

According to the scheme the activity of the nurses was to begin on April 1, 1929 and was to comprise the children born alive in their districts during the ensuing five years. Pursuant to this scheme the transmission of the reports from the population-registers of the "control-districts" began at the same date and was likewise to comprise all children born alive in these districts during the ensuing five years. Consequently, the whole enterprise could not be brought to an end until a year after the last child under observation had been born, which meant the first of April 1935. Afterwards the material has been reviewed and coordinated.

One of the tasks has been to ascertain whether a "nurse-effect" on the infant mortality could be discovered. I have been able to perform this investigation only for the rural districts, because I had only—on behalf of the Statistical Department—to deal with these districts. Moreover, a corresponding statistical review of the observations originating from the district of Copenhagen has for several reasons not been possible.

Without regard to this latter circumstance it may be of some interest to consider briefly how the existing rather few but first class observations might be utilized in order to get as much use of them as possible. It would, at any rate, be a pity to dispatch them with only a few vapid remarks.

III

In order to elucidate the sizes of the sets of rural districts under comparison we state the extent of the districts and, according to the Danish census of 1930, the numbers of inhabitants.

	Nurse-districts		*Control-districts*	
	Area square miles	Inhabitants	Area square miles	Inhabitants
Insular districts	61	7,950	162	23,000
Jutland	157	12,200	148	22,100
Total	218	20,150	310	45,100

In spite of the rural character of the districts it may easily happen that there are urbanized agglomerations within the districts presenting hygienic and social conditions which may differ slightly from the other part of the same district. In this respect the selection of the districts, however, must be considered rather fortunate. We quote the number of inhabitants of urban agglomerations within the districts; the areas, on the contrary, are not recorded in Danish statistics.

	N-districts	C-districts
Insular district	—	2,235
Jutland	1,904	3,751
Total	1,904	5,986

Thus the population of the agglomerations constitutes a rather negligible part of the entire population of the districts.

As will be seen the extent of the C-districts was about twice that of the N-districts. Whether districts of these sizes might be supposed to be sufficiently large for a final conclusion to be drawn concerning the significance of the difference between the mortality of each of the districts must necessarily depend upon the actual difference finally arrived at; and, of course, this could not possibly be stated from the very beginning. The extent of each of the N-districts was limited beforehand, however, by the amount of work a single nurse would be able to do; consequently no reason was found for enlarging the C-districts beyond several times the size of the corresponding N-district.

During the five years ending March 1934, the number of children born alive in the districts were the following;

	N-districts	C-districts
Insular district	745	2,022
Jutland	1,451	2,013
Total	2,196	4,035
Viz:		
Boys	1,131	2,087
Girls	1,065	1,948
Legitimate	2,087	3,769
Illegitimate	109	266

Now, it was an important part of the activity of the nurses to succeed in obtaining entrance to the homes. If only a certain small proportion of the children in the nurse-districts were superintended it might be feared that this proportion would represent those living under particularly bad hygienic and social conditions, who to be sure were more in need than the remainder of the nurse-assistance offered, but who would at the same time tend to give us an impression of the mortality which is below the actual level. Thus, the ability of the nurses did not especially depend on their professional skilfulness but a certain amount of policy and discretion were also required.

In this purely human respect the nurses appear to have been extremely successful, at any rate they managed to get into touch with most of the mothers, cf. the figures below.

Nurse-districts	Number of births	Nurse-controlled children	
		total numbers	per cent of births
Insular district	745	707	94.9
Jutland	1,451	1,382	95.2
Total	2,196	2,089	95.1
Viz:			
Boys	1,131	1,075	95.0
Girls	1,065	1,014	95.2
Legitimate	2,087	1,997	95.7
Illegitimate	109	92	84.4

The following remarks apply to the mortality of these 2,089 nurse-controlled children as compared with the mortality of the aforesaid

4,035 control-children. Amongst the two groups of children 57 and 256, i.e. 2.73 and 6.34 per cent respectively died before entering upon the second year of their life, apparently a considerably lower mortality of the "nursed" children than that of the "non-nursed."

The validity of the immediate statement is completely broken down, however, by two main objections. Firstly, it must be observed that the group of nurse-children comes into existence in quite a different manner from that of the control-children. These latter from the very beginning of their lives made their entrance into the group of this kind of children without any formality. As to the children of the nurse-districts, on the contrary, a certain time had necessarily to elapse, in the first place before the nurse received the information from the birth-register that a child had been born, and in the second place before the nurse on her side could pay her first visit or—if necessary—could persuade the mother to have the child enrolled in the group of nurse-children. Even if the nurse exerted herself to put the negotiations through as quickly as possible, she would also have to wait and see and not be too pushing. Thus the cases in which the child died before the nurse arrived or succeeded in her object must cause entrances into the group of nurse-children exclusively to take place gradually and never immediately at the birth as was the case in the control districts; these different conditions if they remained unconsidered would contribute to diminish artificially the immediate expression of the mortality of the nurse-districts for, as everyone knows, the rate of infant mortality is especially high during the first days or weeks of life.

Secondly, as to the events which decrease the groups, it must further be realized that removals from the districts influence the actual number of deceases as well as the momentary size of the groups, and at the same time the immediate expression of mortality, especially if the removals have a different age-distribution in the two districts.

Consequently, we must consider how the increasing and decreasing occurrences are distributed over the interval from birth to the first anniversary. In performing this task no reason was found for investigating the occurrence of the fluctuations in mortality, which possibly took place during the 6 years of observations. We therefore operate as if all the children under consideration were born at the same moment and were living and departing exactly as contemporaries.

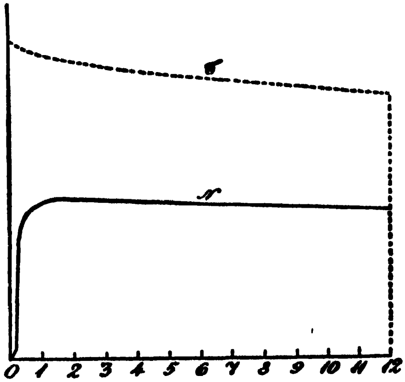
Nor do we pay any attention to the manner in which the size of the two groups has really varied from time to time. On an average they have comprised 390 and 715 children respectively, as seen from the number calculated below; but in fact each of the two groups increased gradually from April 1929 till April 1930, mainly due to new births; then a certain equilibrium appeared, produced, on one hand, by the successive abandonment of one-year-old children, beginning at April 1930, and on the other hand by the steady entrance of new-born children, which two causes nearly compensated each other. This balance continued till April 1934, when no more new-born children were accepted so that the groups gradually decreased during the last year of the investigation, ending April 1935.

IV

How the size of each of the two fictitious groups has altered as functions of age is described in Table I in which the various kinds of events (deaths, immigrations and emigrations) are distributed over the age-intervals quoted. Further the sizes of the groups are added for each of the points of time which separate the intervals employed. In the diagram (Figure 2) the courses of the two functions (N and C) are pictured. As will be seen the group of the control-districts is at full height from the very beginning because no one is introduced later on. For this reason the course of this group is decreasing monotonic.

FIGURE 2

AGE-DISTRIBUTION OF THE NURSE-GROUP (N) AND THE CONTROL-GROUP (C)



As to the group of the nurse-districts, on the contrary, it will be seen that the entrances are to some extent scattered over the entire age-interval of one year; even if the greater part (about 75 per cent) of these entrances take place within a week after birth (i.e. three-fourths of all the "nursed" children have been entered into the nursing scheme before they reached the age of one week) this group does not exist from the very beginning and does not reach its maximum size until the age of about two months has been passed.

TABLE I

COMPARISON OF TWO GROUPS

Ages and age intervals (months)	Nurse-districts				Control-districts			
	En-trances	Secessions by		Result-ing group	En-trances	Secessions by		Result-ing group
		decease	removal			decease	removal	
0				0	4035			4035
	1572	0	0		0	89	18	
¼				1572				3928
	279	1	2		0	16	13	
½				1848				3899
	151	1	14		0	14	33	
1				1984				3852
	45	10	21		0	25	64	
2				1998				3763
	23	8	16		0	25	53	
3				1997				3685
	14	14	34		0	49	99	
6				1963				3537
	5	23	44		0	38	155	
12				1901				3344
Total	2089	57	131	—	4035	256	435	—
Vis.								
Boys	1075	33	52	—	2087	148	208	—
Girls	1014	24	79	—	1948	108	227	—
Legitimate	1997	56	98	—	3769	232	344	—
Illegitimate	92	1	33	—	266	24	91	—

On an average of the equilibrium-episode the two curves of Figure 2 also describe the age-distribution of the groups at every moment; computing the areas indicated by the curves we find that the total sum of months in which the children have been living under observation amounts to 23,102 months for the N-districts and 42,919 months for the C-districts. If we divide these amounts by sixty months we find the average-size of each group (390 and 715 respectively) as mentioned above.

From this we can make an estimate of the daily work of the nurses. If for this purpose we assume that x visits a year would suffice for each superintended child and that each of the nurses was able to pay y visits per working day then, putting the year at 300 working-days we obtain $600y = 390x$, which means $y = 0.65x$, giving the following tabulation:

Number of visits per child	Average number of visits per working day
x	y
4	2.6
6	3.9
8	5.2
10	6.5
12	7.8

Thus the nurse-districts could not possibly have been essentially larger. The only manner in which an extension of the field of experience might have been obtained would consequently have been by increasing the number of districts; but this measure would have required more nurses.

If we divide the total sum of months by the total number of children entered in the two groups (2,089 and 4,035 respectively) we find 11.06 months for the N-districts and 10.64 months for the C-districts, which figures express the time each child on an average has been under observation. Even if the children of the nurse-districts have been entered at a higher age (on an average at 8 days old) than the children of the control-districts, the former appear to have been under observation during a longer time than the latter. By a cursory estimation of the figures of the table it will be seen, however, that the children of the nurse-districts have not emigrated by removal to a similar extent as the children of the control-districts, for the number of removals from the N-districts does not in any age-interval amount to nearly half the number of removals from the C-districts as might be expected under equal conditions. Nor do the nurse-children appear to have died to a similar extent as the control-children; for a similar lack of proportionality seems to rule also the number of deceases. This latter circumstance is, however, of decisive importance and requires a closer study.

V

In order to carry through the proposed investigation, several ways might be taken. Without discussing such possibilities we prefer to utilize the observations as they lie before us in the aforementioned table; and since the existence of deaths as well as of migrations as simultaneously altering causes constitutes the problem of grasping from this muddle the effect of the mortality, we propose in this connection to compute those probabilities for surviving a given age-interval which *J. Karup*[2] has termed independent probabilities, for which probabilities, p, we have the following formula applying to a not too large interval;

$$-\log p = \frac{D}{S_0 - S_1} \log \frac{S_1}{S_0}.$$

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[2] For instance in the "Finanzlage der Gothaischen Staatsdiener-Witwen-Societät"; but the considerations, underlying the theory of independent probabilities, may be found elaborated and critically described for instance by P. Spangenberg: "Die Karupsche Theorie der unabhängigen Wahrscheinlichkeiten," (*Veröffentlichungen des deutschen Vereins für Versicherungswissenschaft*, Heft XX, Berlin 1911, p. 91), or by P. E. Böhmer: "Theorie der unabhängigen Wahrscheinlichkeiten," (*Septième Congres international d'Actuaries*, vol. II, Amsterdam 1912, p. 327).

In this formula D denotes the number of deceases occurring during the interval and S_0 and S_1 the size of the group at the beginning and at the end of the same interval. It should be observed that an elementary transformation shows that we simply must have

$$-\log p = D/S_0$$

if it happens that $S_0 = S_1$.

If we apply this formula to each of the intervals indicated in the table, we find the following values for $-\log p$ where the symbol $\log p$ denotes natural (Napierian) logarithms

Interval (months)	Values of $-\log p$	
	N-districts	C-districts
0– ¼	—	0.02236
¼– ½	0.00058	0.00410
½– 1	0.00053	0.00362
1– 2	0.00504	0.00656
2– 3	0.00405	0.00670
3– 6	0.00707	0.01356
6–12	0.01190	0.01105

As to the N-districts no value for $-\log p$ has been computed for the interval 0–¼; this lack is merely a statement of the fact that proper observations actually fail in this instance, simply because the group, when merely in the phase of creation, cannot possibly at the same time yield mortality-experiences. Much the same also applies to the following two intervals, though to a slighter extent. Upon the whole the statement of the mortality of the N-districts for these early intervals cannot be considered as particularly clear.

The values of $-\log p$ are given by means of natural logarithms; this may be useful if we want to consider the probability, q, of dying before exceeding a given interval instead of the probability, p, of surviving it; for then at any rate we have

$$-\log p = -\log(1-q) = q + \tfrac{1}{2}q^2 + \tfrac{1}{3}q^3 + \cdots$$

and using the smaller intervals we should be completely satisfied by the first term only of this series, putting simply

$$q = -\log p,$$

the values of which probabilities then immediately appear from the tabulation above of $-\log p$.

Further, if we accumulate the values of $-\log p$ we find the ordinary biometric function $-\log l_x$, l_x denoting the number of survivors, the derivative of which function

$$-\frac{1}{l_x}\,\frac{\delta l_x}{\delta x}=\mu_x$$

will furnish us with the intensity of mortality, the biometric function which most obviously describes how mortality varies as a function of age.

In the same way we obtain the following tabulation of $-\log l_x$:

x (months)	N-districts	C-districts
0	—	−0.02236
¼	0.00000	0.00000
½	0.00058	0.00410
1	0.00111	0.00772
2	0.00615	0.01428
3	0.01020	0.02098
6	0.01727	0.03454
12	0.02917	0.04559

In this table we have arbitrarily put $-\log l_x=0$ for $x=\frac{1}{4}$ month and thus we have started the accumulation from this origin.

This means again that the corresponding values of l_x do not start for $x=0$ at identical radices, a fact, which is of no importance, however, in view of the computation of the force of mortality.

In order to compare on one hand the mortality of the two districts and on the other hand the conditions of these districts with those of Denmark as a whole we have also computed the corresponding values of $-\log l_x$ from the data of the official statistics concerning the infant mortality of the whole country; these data, however, treat the interval from $x=\frac{1}{4}$ to $x=1$ under one heading only; starting as above, the accumulation at $x=\frac{1}{4}$ we obtain for the whole of Denmark the following values:

x (months)	$-\log l_x$	x (months)	$-\log l_x$
0	−0.02245	3	0.02296
¼	0.00000	6	0.03836
1	0.00822	12	0.05464
2	0.01536		

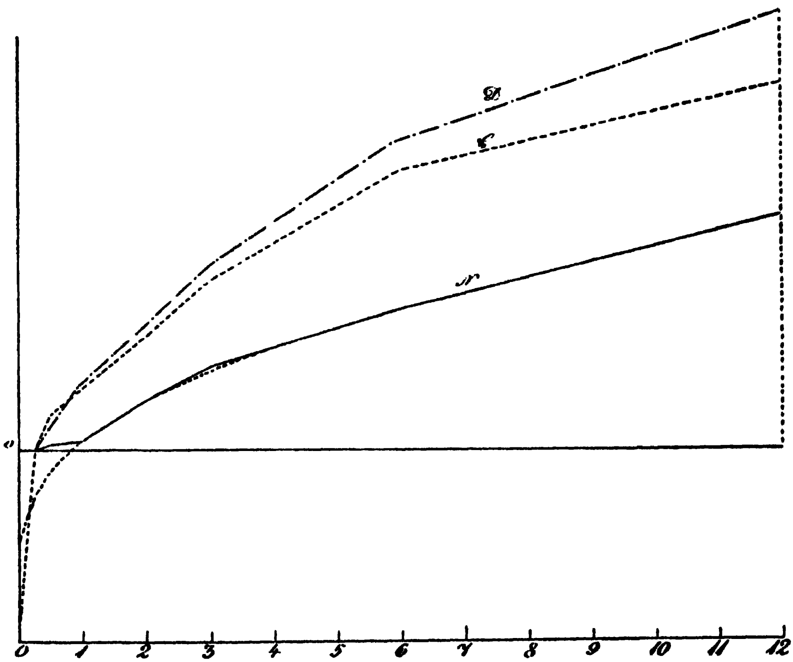
Now, in order to illustrate the different manner in which $\log l_x$ for each of the three systems (in the following denoted N, C, and D, respectively) ascends with increasing age we have plotted the stated values of $-\log l_x$ in the annexed diagram (Figure 3) and further connected successive points of each system by straight lines.

By these polygons we should be enabled to distinguish the three systems of points more easily. It must be a matter of course that $-\log l_x$ cannot be supposed to vary minutely according to these lines; they have been drawn only in order to facilitate the distinction.

The different manner in which the three sets of points actually ascend with increasing age affords an excellent illustration of how the mortality in the three groups under consideration varies within ages from $\frac{1}{4}$ to 12 months; we see immediately that the D-polygon ascends more rapidly than the C-curve and this curve again more rapidly than the N-curve.

FIGURE 3

COURSE OF $-\log l_x$



In this survey the latter curve moreover appears to ascend particularly slowly over the intervals from $x=\frac{1}{4}$ towards $x=1$. But whether this peculiarity originates from the natural circumstance that the nurses had nothing to do where the child was dying or had just died on their arrival—a well-known phenomenon of selection in several other connections—or whether the slow ascent is due to the lack of sufficient observations, does not call for any attention in this connection. However, one can, on the whole, scarcely escape the obvious impression that the mortality of the N-districts is at a lower rate than the mortality of the C-districts, though the latter, compared with the infant mortality of the whole country must be considered rather low.

Those who possess a closer knowledge of the hygienic and social conditions of the various localities of the country can have no doubt that the chosen control-districts as to mortality in general, belong to the better part of the country, a circumstance which, of course, is worth noticing in the present connection.

VI

We have attached these remarks to the diagram in Figure 3 and the values of $-\log l_x$ instead of attaching them to a description of the derivative function of $-\log l_x$, i.e. the intensity of mortality. For since the computation of this latter function

$$\mu_x = -\frac{\delta \log l_x}{\delta x}$$

requires some sort of differential gear, it cannot be performed without a preceding adjustment of the stated values of $-\log l_x$, requiring in its turn certain assumptions, which in fact may be considered superfluous for the topic before us.

If, however, we want to study more closely how the intensity of mortality of the three groups may after all be supposed to run, there is nothing to prevent us, of course, from trying to make the adjustments necessary. Even if the mortality of the three groups on an average must be supposed to range the groups as recently described, it is still left for further consideration to investigate to what extent the average differences may be recognized over the entire interval from, say one month to one year; for when comparing the mortality of various groups—especially in the treatment of infant mortality—we have to realize that the mortality of each group must be substantiated by a certain function of age, not by a single numerical term.

Here again, in order to perform the desired adjustment various roads may be taken. A method which appears to involve a smaller amount of arbitrary assumptions than any other is probably the one I have proposed to call pseudo-analytical graduation.[3]

Though this procedure should be particularly applicable for our present purposes, we propose, however, to take up a more conventional line, choosing a proper analytical function, the constants of which may be found by a regular adjustment according to the method of least squares. The reason why we do so is the plain one that particularly for application in the case of infant mortality we possess a most convenient expression, analytical and linear with respect to its constants, originating from Professor Oppermann (1817–1883) the Danish actuary, who is but too little known. Oppermann's formula[4] runs as follows

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[3] Cf. H. Cl. Nybølle; "On pseudo-analytical graduation," *Journal of the Institute of Actuaries*, vol. LXVI. Part I. No. 314, London 1935.

$$-\log l_x = a + b\sqrt{x} + cx + dx\sqrt{x}$$

or, if we want to express directly the intensity of mortality,

$$\mu_x = \tfrac{1}{2}b/\sqrt{x} + c + \tfrac{3}{2}d\sqrt{x}$$

As to the range of ages over which this formula may be considered to apply, there is no reason for discussing this question here. Referring to the papers quoted above, it will suffice to emphasize that a close fit must be expected when we treat only the limited interval 0–1 year.

Now, the adjustment can be performed in a straight-forward manner; from the formula

$$-\log l_x = a + b\sqrt{x} + cx + dx\sqrt{x}$$

we deduce the following one

$$\begin{aligned} -\log (l_y - l_x) &= -\log p_x \\ &= b(\sqrt{y} - \sqrt{x}) + c(y - x) + d(y\sqrt{y} - x\sqrt{x}) \end{aligned}$$

and putting here gradually for x and y the values limiting the intervals, used above in the tabulations of $-\log p$, we obtain the observation—equations; from these equations again we have to form the ordinary normal-equations, the solution of which will furnish us with the values of the constants b, c and d.

In the formation of the normal-equations concerning the C- and D-systems of Figure 3 we have assumed that all the observation-equations have equal weight; for the groups from which the values of the $-\log p$ of these two systems have been calculated are monotonic decreasing and the decrements of the considered interval (0–1 year) amount to such relatively restricted values that a real effect in this connection could scarcely be expected even if they were properly considered.

As to the adjustment of the N-system, the matter is quite different. Here the various values of $-\log p$ must be estimated as being of un-equal accuracy even to the extent that the adjustment of the N-polygon of Figure 3 ought to be performed only from the data concerning the interval of say $x=1$ to $x=12$. On the other hand, we have counted all the observed values of $-\log p$ within this interval as being of equal accuracy.

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[4] Cf. The Insurance Record (Institute of Actuaries) 1870, February 11th. See also: J. F. Steffensen: "Infantile mortality from an actuarial point of view," *Skandinavisk Aktuarietidsskrift*, vol. XIII, Uppsala 1930, p. 272.

By these adjustments we have found the following values for the constants of the formula $b\sqrt{x}+cx+dx\sqrt{x}$

	b	c	d
N	0.01774	−0.00326	0.00049
C	0.04453	−0.01132	0.00129
D	0.04014	−0.00894	0.00112

Analytically these values describe very nicely the course of the polygons N, C and D in Figure 3; to the N-diagram we have added, by a dotted line, the course for x-values smaller than those directly used for the adjustment; in the remainder of the interval the N-polygon and its adjustment are scarcely distinguishable if we try to picture both of them in the diagram.

From the adjusted values of $-\log l_x$ we may express by means of a single term the mortality of each group, considering the difference $\log l_y - \log l_x = \log p_x$, and from this difference again we may compute either the probability, p, for surviving the interval from x to y or its complementary amount, $q=1-p$. Confining ourselves—on account of the lack of sufficient observations from the earliest ages in the N-districts—to the interval from say 1 month to 12 months, we find the following values for the probability that a child, having passed the age of one month, will die before reaching the age of 12 months, the observed probabilities being compared with the adjusted ones.

	Observed	Adjusted
N-system	0.02767	0.02736
C-system	0.03716	0.03691
D-system	0.04543	0.04497

Thus the agreement between the two sets of values must be considered rather fine.

Now we can also compute the course of the force of mortality for each system according to the formula

$$\mu_x = \tfrac{1}{2}b/\sqrt{x} + c + \tfrac{3}{2}d\sqrt{x}$$

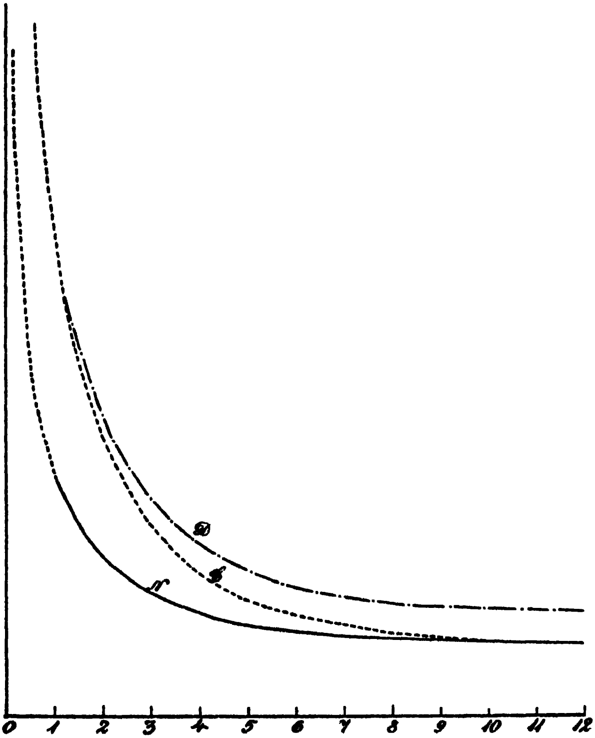
and we then find the following table where the μ-values, however, have been multiplied by 12 in order to express them in the conventional way, using one year as unit.

Age (months)	Force of mortality N	C	D
1	0.076	0.155	0.155
2	0.049	0.086	0.092
3	0.038	0.059	0.067
6	0.026	0.030	0.040
9	0.023	0.023	0.033
12	0.022	0.022	0.032

From these figures as well as from the survey given in Figure 4, where the course of μ_x for each of the three systems has been pictured, we see how the mortality of the C-system runs between the N- and D-systems; at the beginning of the interval no difference between the C- and D-systems is noticeable, on the other hand, towards the end of the interval no difference is found between the C- and N-systems. Whether this peculiarity suggests something concerning the N-districts or something concerning the C-districts or—as a third pos-

FIGURE 4

FORCE OF MORTALITY AS A FUNCTION OF AGE



sibility—something concerning both of them, may finally be a matter of opinion. *At any rate, we can scarcely make a more perspicacious image of the effect on infant mortality of the present nurse experiment.*

If from the course of μ_x we want to find how much infant mortality may be supposed to have been diminished by the nursing scheme we may compare the values of

$$\int_1^{12} \mu_x \, dx = \log l_1 - \log l_{12};$$

for each of the three systems considered in which case we find the following values for this integral:

	Observed	Adjusted
N	0.02806	0.02773
C	0.03787	0.03761
D	0.04642	0.04601

Thus, on an average, the mortality of the N-districts amounts to only 74 per cent of the mortality of the C-districts though the mortality of the latter does not amount to more than about 80 per cent of the mortality for Denmark as a whole. As far as can be seen the nurses, consequently, appear to have succeeded in reducing the mortality to a level similar to that found in the other Scandinavian countries.

VII

Even if these results may be suggestive of a happy effect of the interesting nurse-experiment, it must, however, be realized that the number of observations at our disposal have been rather limited. It may also be questioned, to what extent the size of the material, in a strictly statistical sense, may warrant this suggestion.

To deal with this question, too, it would be a straight-forward method to turn to the figures by which we have tried to express the mortality in a single term, for instance the probabilities of dying which we have considered above. But trying also to compute immediately the standard deviations, we are faced with the question: "How many observations have been spent on the numerical estimation of them?" and here the extent of the material is not given immediately by the size of the group quoted in the table, these groups having been influenced not only by deceases but also by migrations.

Consequently, we had better consider again each of the intervals used, and for each of these we prefer to consider the probability, q, of dying before exceeding it, for which probability we simply have

$$q = -\log p$$

as stated above.

As to the number of observations which may reasonably be estimated as having been spent on the computation of these probabilities we have to take advantage of the application of smaller intervals; for, adding to the average size of the group of a given interval something like half the number of the deceases during the interval, we must arrive at a usable expression for the number of children exposed to risk, assuming that the group has diminished only by desease.

We are now enabled to obtain the standard deviations of the probabilities, *q;* further, we are enabled to unite the results from some or all of the intervals if we compute the expected numbers of deaths as well as the standard deviations of the latter, adopting for this computation a population of children of a certain arbitrary but fixed age-distribution chosen anyhow, but successively submitted to the mortality of the N- and C-districts quoted above. For this purpose we have chosen an age-distribution fairly similar to that of the two districts, viz:

Exact ages (months)	Exposed to risk
¼	161
½	169
1	172
2	170
3	167
6	161

Considering first the whole interval from, say, ¼ month to 12 months we obtain, by well-known algorithms,[6] the following result:

	Expected deaths	Standard deviation
N-districts	4.83	0.64
C-districts	7.58	0.58
Difference	2.75	0.86

Since the difference amounts to more than three times the standard deviation, the lower mortality of the N-districts can scarcely be assumed to be exclusively due to purely accidental circumstances; but this very fact does not entitle us to think that consequently the difference must be exclusively due to the nurse-effect; several other causes may have contributed, for instance the unquestionable phenomenon of selection, mentioned above, which appears almost invariably when we have to define ideally a certain group of persons usable for the measurement of mortality, and have afterwards to make the distinction between the persons belonging to the group and those who do not.

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[6] H. Westergaard: "Scope and method of statistics," chapter IX. *Quarterly Publications of the American Statistical Association,* XV (1916), p. 225; elaborated in the text-book (by Westergaard and the present author): *Grundzüge der Theorie der Statistik.* Jena 1928, §344.

If for this reason we confine ourselves to the interval from one month to twelve months we find by a corresponding estimation:

	Expected deaths	Standard deviation
N-districts	4.65	0.62
C-districts	6.31	0.49
Difference	1.66	0.79

Now the difference does not amount to more than 2.1 times the standard deviation; and thus the number of observations appears to be rather limited in order to satisfy those who might doubt that statistical methods should be able to prove the relevance of a practical measure; for several reasons it would, however, scarcely be possible to imagine the existence of anyone who might doubt the possibility of lowering infant mortality at all by better nursing; but this is quite another story.

STATISTICAL AND ECONOMIC PROBLEMS IN THE ADMINISTRATION OF SOCIAL SECURITY*

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There can be no clear understanding of the statistical and economic problems confronting social scientists in this newly-developed field of social security until there is some appreciation of the administrative complexities which it presents. Therefore, as an introduction to the subject of this paper a brief review of the administrative background of the Social Security Act is necessary.

To begin with, the social security program is a combination of federal and state-federal administration. The old-age benefits administration is on a strictly federal basis, while public assistance and unemployment compensation are both administered by the states with a certain amount of federal supervision.

Furthermore, there exists in the different parts of the program a varying amount of decentralization. Any program which is administered on a state basis is, from a federal standpoint, somewhat decentralized, but of course there may be further decentralization within the state itself down to the municipalities and counties. The states vary in this respect. Meantime the federal part of the program is being partially decentralized, at least insofar as the Social Security Board is concerned, by the establishment of twelve regional offices scattered throughout the country. From a research point of view, the more decentralization there is the more difficult it becomes to obtain uniform data on a nation-wide basis.

Lastly, the organizational structure of social security is rather complex, both in Washington and in the states. In Washington there are the following agencies: the Social Security Board, the Children's Bureau and the Employment Service of the Department of Labor, the Office of Education of the Department of the Interior, and the Public Health Service and the Bureau of Internal Revenue both of the Department of the Treasury. In the states, public assistance is sometimes concentrated in a welfare department, although occasionally there are several independent agencies in this field. Unemployment compensation is usually placed in the State Department of Labor with the Employment Service associated therein, but this pattern is not universal. In summary, it may be said that the organizational structure of the social security program is so complex that it accentuates the technical problems which already exist.

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BASIC STATISTICAL PROBLEMS

Using this description of the administrative structure of social security as a background, let us turn our attention to the statistical and economic problems with which this paper is primarily concerned. The first and most basic problem is that of translating the data which must be assembled for administrative purposes into data which will serve the needs of longer-range research as well as the more immediate needs of public information. In this connection it must be made clear that there will be in the social security program very little collection of data for purely informational purposes. Practically all the data for such purposes must be converted from other uses, and the main difficulties facing us are those incident to such a conversion.

Some idea of the wealth of data which must be collected for the bulk of the working population of the country may be obtained from the following list of items, all of which are required for administration: monthly employment and payrolls by states and by covered industries; in most instances quarterly and annual earnings for each individual worker; length of unemployment for which benefits are paid; amount of benefit payments; and a number of other items of equal value. The question is, can these data be made available to serve general research and informational purposes, or will they be lost in the maze of administration. The problem for a research man is how to provide for forms, methods of procedure, machinery, and other devices which will insure the availability of such administrative data.

I should like to press this point home with a very concrete and specific example—the problem of office machinery. Broadly speaking, economists and statisticians are lamentably ignorant of the operation and uses of office machines. Many research men know nothing whatever about tabulating or bookkeeping equipment. It may surprise some of you to know that the kind of information which will be available to the public on the social security program may be governed fully as much by the office equipment which is adopted in administration as by the quality of the research brains in the field of social security. Thus has technology invaded the most sacred precincts of research!

This question of machinery has been brought to my own personal attention within the past year through the necessity of making a sharp distinction between statistics and accounting. In the early stages of our work we subscribed whole-heartedly to the principle that statistics are a by-product of accounting, but the year's intensive experience in struggling with this problem has led me now to stress the opposite principle: namely, that the collection and processing of statistics must be an independent operation—independent, that is, of administrative procedure. There is, no doubt, a certain sense in which it is good economy to obtain the data for public information from routine administrative operations. There are, however, such important differences between statistics and accounting that great care is necessary lest the statistics be completely snubbed out of existence.

Let me emphasize briefly the sharp differences which necessarily exist between statistics and accounting. The latter is exact, involving the counting of the last penny; it must deal with the whole universe of items, because the purpose is to account for everything; lastly, its methods are those of addition, that is, the obtaining of counts of totals and sub-totals. The science of statistics, on the other hand, operates on an entirely different basis: it need only be approximate, not exact; it can work through samples rather than using the universe; and its methods are largely those of classifying and grouping comparable items. The conclusion is that statistical work requires an independent set-up, with machinery and tabulating equipment suitable to its processes. In other words, the statisticians must be properly implemented to perform the tasks which are required of them. There must be a fruitful union of technology and brains if we are to get the best results in this new field of research.

TECHNICAL PROBLEMS

We come now to a second group of knotty problems; namely, those of a technical and statistical character. In public assistance, for example, there is the problem of coordinating the data for a bewildering variety of programs so as to produce a unified and consistent whole. This is the field in which we have had, either concurrently or successively, such programs as the Federal Emergency Relief Administration, the Civil Works Administration, the Local Works Division, the Works Progress Administration, the Resettlement Administration, the National Youth Administration, Social Security, and a variety of others. It is this wide variety which in itself is partly responsible for the fact that it has never been possible to estimate with accuracy the number of persons and families dependent on public and private assistance throughout this last depression.

At the present time a determined effort is being made to develop some statistical series which will present a unified picture of the whole relief and welfare program of the nation. In the Bureau of Research and Statistics of the Social Security Board we are now, in addition to our regular series on *public assistance* to the aged, the blind, and to dependent children, also compiling data on total *relief* and *assistance* expenditures in 118 urban centers; this is a series which was taken over from the Children's Bureau of the Department of Labor. In addition, we have a rural series covering all expenditures in 335 rural counties scattered throughout the country. This series has just been taken over from the Works Progress Administration, which originated it about two years ago. Both the urban and the rural series, which are based on sample cities and counties, represent *all types of expenditures, public and private,* in each of the selected communities. A third series is that on *general relief* in the states, the data being collected from state and county relief administrations or welfare departments. This series has been carried on for the past year in collaboration with the Works Progress Administration, but has recently been taken over by the Social Security Board. Out of all these different series, it is hoped that eventually a unified picture of the relief and assistance situation in the United States can be presented.

In the field of unemployment compensation there are a number of special problems, the most important of which exists in employment and payrolls. For a number of years the Bureau of Labor Statistics of the Department of Labor has been compiling statistics of employment and payrolls in manufacturing and non-manufacturing industries. The original data consist of reports made once a month by sample firms in the respective industries. Employment is reported as the number of persons listed on the weekly (or other type of) pay period ending nearest the fifteenth of the month, while the dollars of payroll represent the wages earned in that pay period by these employees. The two sets of figures—employment on the one hand, payroll on the other—are complementary to each other and are closely comparable.

In unemployment compensation we obtain the total wages earned for the month by all covered employees, both manual and clerical, on all types of pay periods—weekly, semi-monthly, monthly, or others. The report on dollars of payroll is, therefore, more comprehensive than the similar report of the Bureau of Labor Statistics in that it covers all wages earned during a given period of time. The difficulty is that there is no very satisfactory way of determining the number of employees which should be related to this amount of payroll. The figure which is theoretically the most nearly exact is the arithmetic average of the numbers of persons appearing on all different types of payrolls during the month. But this is a figure which is cumbersome to compute. As an alternative, we have been experimenting with the idea of using the number of persons appearing on all types of payrolls at a certain period in the month; say, for example, the numbers represented on all payrolls ending nearest the fifteenth of the month, or the numbers represented on the last payrolls ending within the month. However, such a figure is relatively independent of the total dollars of payroll earned during the month and, therefore, we do not have in our unemployment compensation program the close tie-up which exists in the Bureau of Labor Statistics between employment on one hand and payrolls on the other. We select what amounts to two different types of figures, hoping that the relationship between the two will be close enough to enable us to use them together, although not for the same broad purposes as can be done with the Bureau of Labor Statistics series.

Still another illustration arises from these same figures. The Bureau of Labor Statistics, selecting a single week in a given month, is not worried about a differing length of the month. They can easily obtain monthly indexes having the character of a trend. We, on the other hand, obtain payrolls for the entire month and, therefore, our months are not strictly comparable with each other, if in one there are only four weekly payrolls while in the next there are five such payrolls. Thus, while we have obtained a wealth of data far beyond that previously available in this field, the disturbing factor is that this has been accomplished by a loss of precision which is going to cause considerable difficulty to statisticians and economists.

Still another problem in unemployment compensation is deserving of some attention. Most of the state laws provide for a merit-rating for employers, based upon their respective experiences in stabilization of employment. We do not yet know exactly what form this merit-rating will take, but there is the clear implication that in some instances, at least, the nature of the industry will be taken into account in determining an employer's record of stabilization. Therefore, the classification of industries which is adopted by Social Security will be very important for unemployment compensation purposes, and we may be sure in turn that the operation of merit-rating systems in unemployment compensation will produce a marked effect upon industrial classification systems in use in this country.

Finally, in the field of old-age benefits there are a few technical problems which require mentioning in this connection. Through the reporting system established for old-age benefit purposes we shall have available quarterly and annual earnings of individual workers on a scale never before witnessed in this or any other country. The statistical value of these data is somewhat impaired by the fact that these earnings reports cover the earnings of individuals up to $3000 per year only. There is the additional complication that these earnings reports differ from those in unemployment compensation, which cover all earnings, including those over $3000.

Undoubtedly the biggest problem faced in old-age benefits is that of record-keeping, which must extend over a period, in some instances, of half a century for given individual workers. The technical and statistical difficulties involved in such extensive, long-range record-keeping constitute a challenge to the newly-developed office equipment industry, as well as to the accountants and statisticians who must plan for the keeping of these data.

ECONOMIC PROBLEMS

In the third group of social security problems are those of a long-range economic character. It is necessary here only to call attention to a few of these which present immediate difficulty.

In public assistance one of the outstanding problems grows out of the provision that the states must finance their share of the cost. This problem has both an economic and fiscal aspect. In some instances the fiscal situation in the individual states is such as to place a decided limitation upon their participation. Lack of adequate taxation or of borrowing power may prevent the state from raising the required funds to match the federal grant. But even more important is the question of basic economic resources—whether the state has the wealth to support the tax load which would be required to carry a public assistance program. (Some states have been exceptionally liberal in providing funds for recipients.) There are some fundamental issues of relative state capacity to pay which have not yet fully come to light but which are rapidly developing.

Another feature of public assistance involves the relationship existing between the scale of payments to individuals under old-age assistance with the benefit schedules laid down in the Act for old-age benefits. The fact is that for some years to come the payments to needy aged individuals will be more generous than the typical benefits payable under old-age insurance. This paradox will require early attention.

In unemployment compensation the problem of what to do with a man who is not working because of illness will arise as soon as benefit payments begin. Such an individual is not entitled to draw unemployment compensation benefits because he is not available for work, and yet the family in which the wage earner is unemployed because of illness is fully as much in need of benefits as the family in which the wage earner is only out of a job. As more and more beneficiaries are deprived of their unemployment benefits because of inability to work, there will be stronger and stronger pressure to include within that benefit system an equivalent set of benefits for sickness or temporary disability.

A little later on, a second problem will arise in connection with those beneficiaries who will have exhausted their rights. When a worker has drawn compensation benefits for a period of thirteen to sixteen weeks, whichever the case may be, he is no longer eligible. But if he still continues to be unemployed, he will undoubtedly question the action of the insurance administration in cutting off his rights to benefits. So long as the number of such individuals is small, the question may be avoided. But in any serious depression in which substantial numbers of workers lose their benefit rights and enter the post-benefit period of unemployment, we may be sure that a strong movement will arise for the continuation of benefits. It is this situation which gave rise to the familiar "extended benefits" of the British system. Some plan for a work program or for an extended benefit grant of some kind will have to be devised in advance of the next depression.

In old-age benefits the problem which has engrossed the attention of critics to the exclusion of almost all others is that of the reserve. The system as at present constituted provides for the establishment of a full reserve. The reasoning back of such a system need not be examined here. It is sufficient to point out that the issue of a full reserve as against a pay-as-you-go policy will be debated extensively during the next few years.

Another difficulty arises from the fact that old-age benefits are not paid on any large scale until 1942. The theory behind this delay is that the beneficiaries must make contributions over a limited period of time before they are eligible for benefits; for the present Act constitutes essentially a contributory system. The question is whether some system can be devised for paying benefits earlier than 1942 and yet maintain the fundamentals of a contributory system.

Still again there is the question as to whether or not a flat-rate benefit might be preferable to the present method. Simply paying a flat amount, say $30 or $40 a month, to all contributors is very appealing to those who are impressed with the administrative difficulties of the present system. On the other hand, anyone who takes thought of the wide differences in standards of living, costs, wages, and in other related factors throughout the United States will realize that a flat benefit payment which would be reasonable in one section might be totally inadequate in another.

This paper does little more than raise questions. It offers no solutions for the basic, technical, and long-range economic problems which are here set forth. However, if these difficulties are seriously faced by social scientists everywhere, and more particularly by statisticians, economists, and administrators who are at work in the social security program, then we may at least have laid a foundation for tackling these problems.

In summary, I should like to say that the social security program is not really an alien principle grafted upon the functioning economic system—in fact, quite the opposite. The social security program, as now written, is readily adaptable to our economic life. I think it is more important at this stage of development to stress its protective features, its insurance aspects, and its lack of serious interference with basic economic practices, than to emphasize its preventive and curative values. It is possible that unemployment compensation, for example, may diminish unemployment and that old-age benefits will lead to increased savings for old age. But the really important point is that social security represents an attempt to protect the individual and to insure him against some of the hazards of our modern economic system without interfering with the ordinary operation of that system. Hence social security may turn out to be a device which will reinvigorate our existing economic system.

ON THE SIMULTANEOUS DETERMINATION OF THE ELEMENTARY REGRESSIONS AND THEIR STANDARD ERRORS IN SUBSETS OF VARIABLES*

By JACOB L. MOSAK
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IN A RECENT article on the determination of multiple regression constants[1] F. V. Waugh developed a method of deriving the statistical measures of relationship in a set of m variables in terms of the values $P_{ij}=\Delta_{ij}/\Delta$, where Δ_{ij} is the cofactor of r_{ij} in the zero order correlation matrix, and Δ is the determinant value of that matrix. If the variables are expressed in terms of standard deviation units $(z_i=x_i/\sigma_i)$, the regression equations become:

$$(1) \qquad z_i = \beta_{i1}z_1 + \cdots + \beta_{ij}z_j + \beta_{ik}z_k + \cdots + \beta_{im}z_m \,.$$

The problem is to determine the β's and their standard errors, and to adjust them for the omission of a variable. Designating by n the number of sets of observations and by m the number of variables we have,

$$(2) \quad \beta_{ij} = -P_{ij}/P_{ii}\,,$$

$$(3) \quad r_{ij} = (\beta_{ij}\beta_{ji})^{1/2} = \frac{-P_{ij}}{(P_{ii}P_{jj})^{1/2}} \quad \text{(Coefficient of partial correlation),}$$

$$(4) \quad \bar{S}_i = (1/P_{ii})^{1/2} \quad \text{(Standard error of estimate),}$$

$$(5) \quad \bar{\epsilon}_i = \left(\frac{n}{n-m}\bar{S}_i^2\right)^{1/2} \quad \text{(Quadratic mean error),}$$

$$(6) \quad R_i = (1-\bar{S}_i^2)^{1/2} \quad \text{(Coefficient of multiple correlation), and}$$

$$(7) \quad R_i' = \left(1-\frac{n-1}{n-m}\bar{S}_i^2\right)^{1/2} \quad \text{(Adjusted coefficient of multiple correlation).}$$

The quantities ${}_ic_{jk}$ necessary in order to compute the standard errors of the parameters as well as of the function[2] are given by the equation:

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* I wish to thank Professor Henry Schultz for his encouragement, without which this article would not have been written.

[1] Frederick V. Waugh, "A Simplified Method of Determining Multiple Regression Constants," this JOURNAL, 30 (1935), pp. 694–700.

[2] For an explanation of the standard error of a function, see Henry Schultz, "The Standard Error of a Forecast from a Curve," this JOURNAL, 25 (1930), pp. 139–185.

The quantities ${}_ic_{jk}$ correspond to the quantities $[\alpha\alpha]$, $[\beta\beta]$, $\cdots$, $[\mu\mu]$, $[\alpha\beta]$, $\cdots$, $[\alpha\mu]$, in Professor Schultz's symbols. It should be noted, however, that Professor Schultz deals with original and not with standard deviation units.

$$ {}_ic_{jk} = (P_{ii}P_{jk} - P_{ij}P_{ik})/(nP_{ii}) \,. \tag{8-a} $$

With the aid of an elementary theorem in determinants, which states that

$$ \Delta\Delta_{ijkl} = \Delta_{ij}\Delta_{kl} - \Delta_{il}\Delta_{jk} \,, \tag{9} $$

it may be seen that (8-a) readily reduces itself to the more familiar form:

$$ {}_ic_{jk} = \Delta_{iijk}/(n\Delta_{ii}) \,. \tag{8-b} $$

The variance of β_{ij} is given by:

$$ \sigma^2_{\beta_{ij}} = \bar{\epsilon}_i^{\,2}({}_ic_{jj}) = \frac{n\bar{S}_i^{\,2}}{n-m}\,\frac{P_{ii}P_{jj} - P^2_{ij}}{nP_{ii}} = \frac{P_{ii}P_{jj} - P^2_{ij}}{(n-m)P^2_{ii}} \,. \tag{10} $$

The P_{ij} values may of course be computed by the long-hand method of evaluation of a determinant and its cofactors. In Professor Schultz's statistical laboratory, however, we have found it convenient since the beginning of 1936 to use a modified form of Gauss's method of substitution for the solution of the P_{ij} values. This form, including the directions for solution, is shown in Tables IA and IB.[3] It yields all the elements $P_{ij}=\Delta_{ij}/\Delta$ of the reciprocal matrix. It differs from the so-called Doolittle form for solving normal equations in that there is no separate column involving the dependent variable. In this table each of the variables may in turn be considered as the dependent variable and its regression on the remaining variables be determined by means of the P_{ij} values.

It is an added advantage of this method that the quantities ${}_mc_{jk}$ and ${}_{m-1}c_{jk}$ for the regressions of the m^{th} and the $m-1^{\text{th}}$ variables on the remaining ones may be readily obtained from the computation sheet without recourse to equation (8-a).[4] This is quite important, for in many types of problems some of the elementary regressions do not make sense. Thus in the determination of demand functions in which "time," t, is used as an explicit variable, the regression of t on the remaining variables is generally meaningless.

The computational procedure may be easily seen from our illustration of four variables. The quantities $n({}_4c_{jk})$ for the regression of z_4 on z_1, z_2, and z_3 are simply the elements $(\Delta_{44jk}/\Delta_{44})$ of the reciprocal matrix formed from the zero order correlations of the three independent variables z_1, z_2, and z_3. They may therefore be obtained from Table IA by blocking out the terms involving z_4, and solving in exactly the same manner as we would for P_{jk} in a three-variable problem. Thus:

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[3] I am indebted to Professor Schultz for his permission to use these tables in connection with this note.

[4] Actually the solution is in terms of $n({}_mc_{jk})$ and $n({}_{m-1}c_{jk})$, instead of ${}_mc_{jk}$ and ${}_{m-1}c_{jk}$.

From line 11:

$$n({}_4c_{33}) = \Delta_{3344}/\Delta_{44}\,,$$

$$n({}_4c_{23}) = \Delta_{2344}/\Delta_{44}\,,$$

$$n({}_4c_{13}) = \Delta_{1344}/\Delta_{44}\,;$$

from line 6:

$$n({}_4c_{22}) = (\Delta_{2344}/\Delta_{3344})n({}_4c_{23}) + 1/\Delta_{3344}\,,$$

$$n({}_4c_{12}) = (\Delta_{2344}/\Delta_{3344})n({}_4c_{13}) - r_{12}/\Delta_{3344}\,;$$

and from line 2:

$$n({}_4c_{11}) = -\,r_{12}n({}_4c_{12}) - r_{13}n({}_4c_{13}) + 1\,.$$

By similar reasoning, it follows that we may compute the quantities $n({}_3c_{jk})$ by blocking out from Table IA all terms involving z_3. It is convenient for this purpose to add a line: 14B $= -\Delta_{3344}/\Delta_{33}$ times line 14A of Table IA. Solving as in Table IB we then obtain:

From line 14B:

$$n({}_3c_{44}) = \Delta_{3344}/\Delta_{33}\,,$$

$$n({}_3c_{24}) = -\,\Delta_{2334}/\Delta_{33}\,,$$

$$n({}_3c_{14}) = -\,\Delta_{1334}/\Delta_{33}\,;$$

from line 6:

$$n({}_3c_{22}) = -\,(\Delta_{2334}/\Delta_{3344})n({}_3c_{24}) + 1/\Delta_{3344}\,,$$

$$n({}_3c_{12}) = -\,(\Delta_{2334}/\Delta_{3344})n({}_3c_{14}) - r_{12}/\Delta_{3344}\,;$$

and from line 2:

$$n({}_3c_{11}) = -\,r_{12}n({}_3c_{12}) - r_{14}n({}_3c_{14}) + 1\,.$$

It is important to note that the values $n({}_ic_{jk})$ are not only the weights necessary in computing the standard error of the function but that they are also equal to the P_{jk} values in the subset of variables in which z_i is omitted. This has already been illustrated in the solution of the quantities $n({}_4c_{jk})$, which, we have seen, are equal to $P_{jk(4)}$. (The subscript in parentheses indicates an omitted variable.) The proof is simple. By definition P_{jk} in the subset of variables omitting z_i is

$$(11) \qquad P_{jk(i)} = \Delta_{jkii}/\Delta_{ii} = (P_{jk}P_{ii} - P_{ij}P_{ik})/P_{ii} \text{ (See equation (9).)}$$

But this is also the definition of $n({}_ic_{jk})$ as given by (8).[5] The values

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[5] In his note, "The Analysis of Regression in Subsets of Variables," This JOURNAL, 31 (1936), pp. 729–730, F. V. Waugh defines

$$P_{jk(i)} = \Delta_{jkii}/\Delta = P_{jk}P_{ii} - P_{ij}P_{ik}.$$

It is obvious that the $P_{jk(i)}$ values, so defined, are not analogous to his P_{jk} values. In fact, with his

TABLE IA. FORM FOR THE SIMULTANEOUS EVALUATION OF THE RELATED PARAMETERS IN TERMS OF THE

Line No.	Directions	Reciprocals	A	B	C	D
I			1	r_{12}	r_{13}	r_{14}
II				1	r_{23}	r_{24}
III					1	r_{34}
IV						1
1	I		1	r_{12}	r_{13}	r_{14}
2	$-(1)$	-1	-1	$-r_{12}$	$-r_{13}$	$-r_{14}$
3	II			1	r_{23}	r_{24}
4	$-r_{12}\cdot(1)$			$-r_{12}^2$	$-r_{12}r_{13}$	$-r_{12}r_{14}$
5	$(3)+(4)$			Δ_{3344}	$-\Delta_{2344}$	Δ_{2334}
6	$\frac{-1}{\Delta_{3344}}(5)$	$\frac{-1}{\Delta_{3344}}$		-1	$\frac{\Delta_{2344}}{\Delta_{3344}}$	$\frac{-\Delta_{2334}}{\Delta_{3344}}$
7	III				1	r_{34}
8	$(-r_{13})\cdot(1)$				$-r_{13}^2$	$-r_{13}r_{14}$
8A	$(7)+(8)$				Δ_{2244}	$-\Delta_{2234}$
9	$\frac{\Delta_{2344}}{\Delta_{3344}}\cdot(5)$				$\frac{-(\Delta_{2344})^2}{\Delta_{3344}}$	$\frac{\Delta_{2344}\cdot\Delta_{2334}}{\Delta_{3344}}$
10	$(8A)+(9)$				$\frac{\Delta_{44}}{\Delta_{3344}}$	$\frac{-\Delta_{34}}{\Delta_{3344}}$
11	$\frac{-\Delta_{3344}}{\Delta_{44}}\cdot(10)$	$\frac{-\Delta_{3344}}{\Delta_{44}}$			-1	$\frac{\Delta_{34}}{\Delta_{44}}$
12	IV					1
13	$(-r_{14})\cdot(1)$					$-r_{14}^2$
13A	$(12)+(13)$					Δ_{2233}
14	$\frac{-\Delta_{2334}}{\Delta_{3344}}\cdot(5)$					$\frac{-(\Delta_{2334})^2}{\Delta_{3344}}$
14A	$(13A)+(14)$					$\frac{\Delta_{33}}{\Delta_{3344}}$
15	$\frac{\Delta_{34}}{\Delta_{44}}\cdot(10)$					$\frac{-(\Delta_{34})^2}{\Delta_{44}\Delta_{3344}}$
16	$(14A)+(15)$					$\frac{\Delta}{\Delta_{44}}$
17	$\frac{-\Delta_{44}}{\Delta}$ (16)	$\frac{-\Delta_{44}}{\Delta}$				-1

COEFFICIENTS IN ALL OF THE REGRESSION EQUATIONS AND CORRELATION DETERMINANT AND ITS COFACTORS

R	S	T	U	Sum-Check	Line No.
-1	0	0	0	Σ_1	I
0	-1	0	0	Σ_2	II
0	0	-1	0	Σ_3	III
0	0	0	-1	Σ_4	IV
-1	0	0	0	Σ_1 ✓	1
1	0	0	0	$-\Sigma_1$ ✓	2
0	-1	0	0	Σ_2	3
r_{12}	0	0	0	$-r_{12}\cdot\Sigma_1$	4
r_{12}	-1	0	0	Σ_2 ✓	5
$\frac{-r_{12}}{\Delta_{3344}}$	$\frac{1}{\Delta_{3344}}$	0	0	$\frac{-\Sigma_2'}{\Delta_{3344}}$ ✓	6
0	0	-1	0	Σ_3	7
r_{13}	0	0	0	$-r_{13}\cdot\Sigma_1$	8
r_{13}	0	-1	0	$\Sigma_3-r_{13}\cdot\Sigma_1$	8A
$\frac{\Delta_{2344}\cdot r_{12}}{\Delta_{3344}}$	$\frac{-\Delta_{2344}}{\Delta_{3344}}$	0	0	$\frac{\Delta_{2344}}{\Delta_{3344}}\cdot\Sigma_2'$	9
$\frac{-\Delta_{1344}}{\Delta_{3344}}$	$\frac{-\Delta_{2344}}{\Delta_{3344}}$	-1	0	Σ_3' ✓	10
$\frac{\Delta_{1344}}{\Delta_{44}}$	$\frac{\Delta_{2344}}{\Delta_{44}}$	$\frac{\Delta_{3344}}{\Delta_{44}}$	0	$\frac{-\Delta_{3344}}{\Delta_{44}}\cdot\Sigma_3'$ ✓	11
0	0	0	-1	Σ_4	12
r_{14}	0	0	0	$-r_{14}\cdot\Sigma_1$	13
r_{14}	0	0	-1	$\Sigma_4-r_{14}\cdot\Sigma_1$	13A
$\frac{-\Delta_{2334}\cdot r_{12}}{\Delta_{3344}}$	$\frac{\Delta_{2334}}{\Delta_{3344}}$	0	0	$\frac{-\Delta_{2334}}{\Delta_{3344}}\cdot\Sigma_2'$	14
$\frac{\Delta_{1334}}{\Delta_{3344}}$	$\frac{\Delta_{2334}}{\Delta_{3344}}$	0	-1	$\Sigma_4-r_{14}\cdot\Sigma_1-\frac{\Delta_{2334}}{\Delta_{3344}}\Sigma_2'$	14A
$\frac{-\Delta_{34}\Delta_{1344}}{\Delta_{44}\Delta_{3344}}$	$\frac{-\Delta_{34}\Delta_{2344}}{\Delta_{44}\Delta_{3344}}$	$\frac{-\Delta_{34}}{\Delta_{44}}$	0	$\frac{\Delta_{34}}{\Delta_{44}}\Sigma_3'$	15
$\frac{-\Delta_{14}}{\Delta_{44}}$	$\frac{-\Delta_{24}}{\Delta_{44}}$	$\frac{-\Delta_{34}}{\Delta_{44}}$	-1	Σ_4' ✓	16
$\frac{\Delta_{14}}{\Delta}$	$\frac{\Delta_{24}}{\Delta}$	$\frac{\Delta_{34}}{\Delta}$	$\frac{\Delta_{44}}{\Delta}$	$\frac{-\Delta_{44}}{\Delta}\Sigma_4'$ ✓	17

$n({}_ic_{jk})$ may therefore be used in the same manner as the P_{jk} values to determine all the regression constants in the subset of variables in which z_i is omitted.

TABLE IB. SOLUTION FOR $P_{ij}=\frac{\Delta_{ij}}{\Delta}$

From line 17	$P_{44}=\frac{\Delta_{44}}{\Delta}$ $\quad$ $P_{24}=\frac{\Delta_{24}}{\Delta}$ $P_{34}=\frac{\Delta_{34}}{\Delta}$ $\quad$ $P_{14}=\frac{\Delta_{14}}{\Delta}$
From line 11	$P_{33}=\frac{\Delta_{34}}{\Delta_{44}}\cdot P_{34}+\frac{\Delta_{3344}}{\Delta_{44}}$ $P_{23}=\frac{\Delta_{34}}{\Delta_{44}}\cdot P_{24}+\frac{\Delta_{2344}}{\Delta_{44}}$ $P_{13}=\frac{\Delta_{34}}{\Delta_{44}}\cdot P_{14}+\frac{\Delta_{1344}}{\Delta_{44}}$
From line 6	$P_{22}=\frac{-\Delta_{2344}}{\Delta_{3344}}\cdot P_{23}+\frac{\Delta_{2334}}{\Delta_{3344}}\cdot P_{24}+\frac{1}{\Delta_{3344}}$ $P_{12}=\frac{-\Delta_{2344}}{\Delta_{3344}}\cdot P_{13}+\frac{\Delta_{2334}}{\Delta_{3344}}\cdot P_{14}-\frac{r_{12}}{\Delta_{3344}}$
From line 2	$P_{11}=-r_{12}\cdot P_{12}-r_{13}\cdot P_{13}-r_{14}\cdot P_{14}+1$

Before proceeding to compute a regression equation and its descriptive constants we may want to know whether a given variable z_j, will prove statistically significant. Whether a variable is significant or not is a matter for the statistical analyst to determine in each particular problem in the light of any relevant knowledge which he may possess. In the absence of any knowledge to the contrary, the statistician will generally do well to omit from consideration any variable for which the regression coefficient is smaller than its standard error. The omission of such a variable will always increase the value of R', and the new curve may therefore be considered as giving an improved fit to the data. Stated algebraically, this criterion means that z_j may be

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definition it is no longer true as he says that $R^2_{j(i)}=1-(1/P_{jj(i)})$. The equations for the β coefficients and their variances, however, do hold true even for his definitions, since the denominators cancel.

It was Professor R. A. Fisher who first proposed the method of adjusting the regression coefficients for the omission of a variable. Working under the direction of Professor Schultz, Mr. Milton Friedman extended this method to the adjustment of the weights of the parameters. This procedure was the one used before our form for obtaining the P_{jk} values was developed. Since then we have used equation (11) to adjust the P_{jk} values for the omission of a variable z_i. All our regression constants in the subset of $m-1$ variables are then obtained in terms of the $P_{jk(i)}$ values.

omitted from the regression in which z_i is the dependent variable, if:

(12-a) $$\sigma^2_{\beta_{ij}} > \beta^2_{ij} \, ,$$

or by (10), if

(12-b) $$(P_{ii}P_{jj} - P^2_{ij})/n'P^2_{ii} > \beta^2_{ij} \qquad (n' = n - m) \, .$$

This inequality reduces to

(12-c) $$P_{jj}/P_{ii} - \beta^2_{ij} > n'\beta^2_{ij} \, ,$$

which in turn simplifies into the following forms:

(13-a) $$P_{jj}/P_{ii} > (n' + 1)\beta^2_{ij} \, ,$$

(13-b) $$P_{jj} > (n' + 1) \left| P_{ij}\beta_{ij} \right| \, ,$$

(13-c) $$P_{jj}P_{ii} > (n' + 1)P^2_{ij} \, ,$$

(13-d) $$1 > (n' + 1)\beta_{ij}\beta_{ji} \, , \qquad \text{and}$$

(13-e) $$1 > (n' + 1)r^2_{ij} \, .$$

If we use as a test of significance the inequality

$$\sigma^2_{\beta_{ij}} > k\beta^2_{ij} \, ,$$

the inequalities above still hold but with kn' substituted for n'. This is a relatively simple test which may in most cases be applied mentally.[6] It is given here not so much because it is labor saving—it involves only the terms in the numerator of σ^2 [compare (10) and (13-c)] and can be applied mentally before computing either β or σ—but in order to shed some additional light on the conditions for the statistical significance of a variable. This is especially true of formulas (13-d) and (13-e) which can be used even when the regressions are determined by some other method than that given here and when the computations of the standard errors are more time-consuming. More important, still, is the fact that from the symmetrical form of (13-c), (13-d) and (13-e) it follows that if β_{ij} is significant (or not significant), β_{ji} is also significant (or not significant).

If two variables prove statistically insignificant we may want to know whether one of them will become significant when the other is omitted. The omission of one variable would increase $n'(=n-m)$ by 1, so that our test of significance may be stated as follows:

The variable z_j will be insignificant when z_k is omitted from the regression in which z_i is the dependent variable, if:

(14-a) $$1 > (n' + 2)\beta_{ij(k)}\beta_{ji(k)} \, ,$$

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[6] The test was developed independently by Dr. Y. K. Wong and myself. Formulas (13-d) and (13-e) are due to him.

$$(14\text{-b})\qquad 1 > (n' + 2)({}_kc_{ij})^2/({}_kc_{jj}\,{}_kc_{ii})\,,$$

$$(14\text{-c})\qquad 1 > (n' + 2)\frac{(P_{ij}P_{kk} - P_{ik}P_{jk})^2}{(P_{jj}P_{kk} - P^2_{jk})(P_{ii}P_{kk} - P^2_{ik})}\,.$$

It may be well at this stage to attempt to give some meaning to the P_{ij} values other than the purely statistical definition: $P_{ij} = \Delta_{ij}/\Delta$. It will be most convenient to use an illustration of four variables. Let:

$$(15)\qquad \begin{cases} v_1 = z_1 - \beta_{12}z_2 - \beta_{13}z_3 - \beta_{14}z_4 \\ v_2 = z_2 - \beta_{21}z_1 - \beta_{23}z_3 - \beta_{24}z_4\,. \end{cases}$$

Then it can easily be shown that

$$(16)\qquad P_{12} = \frac{\Sigma v_1v_2}{n}\bigg/\left(\frac{\Sigma v_1^2}{n}\,\frac{\Sigma v_2^2}{n}\right).$$

In words, this formula states that P_{12} is the ratio of the covariance of the residual variates v_1 and v_2 to the product of their variances. It follows that the absolute value of β_{12} $(=P_{12}/P_{11})$ is the ratio of the covariance of the variates v_1 and v_2 to the variance of v_2. The proof is simple:

$$(17)\qquad \Sigma v_1v_2/n \equiv \Sigma(z_1 - \beta_{12}z_2 - \beta_{13}z_3 - \beta_{14}z_4)v_2/n\,.$$

By the least squares curve-fitting procedure we have

$$(18)\qquad \Sigma v_2z_1 = \Sigma v_2z_3 = \Sigma v_2z_4 = 0\,,\qquad \text{and}$$

$$(19)\qquad \Sigma v_2z_2 = \Sigma v_2^2\,.$$

Substituting equations (18) and (19) in equation (17), we have:

$$(20)\qquad \Sigma v_1v_2/n = -\beta_{12}\Sigma v_2^2/n,$$

from which it follows that

$$(21)\qquad \frac{\Sigma v_1v_2}{n}\bigg/\left(\frac{\Sigma v_1^2}{n}\,\frac{\Sigma v_2^2}{n}\right) = -\beta_{12}\frac{\Sigma v_2^2}{n}\bigg/\left(\frac{\Sigma v_1^2}{n}\,\frac{\Sigma v_2^2}{n}\right)$$
$$= -\beta_{12}P_{11} = P_{12}\,.$$

Whether this interpretation of P_{ij} will prove fruitful remains to be seen.

CORRELATION BETWEEN MEANS AND STANDARD DEVIATIONS IN FIELD EXPERIMENTS*

By F. R. Immer
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Studies of association between means and standard deviation of plots in field experiments are of both theoretical and practical interest. It is well known that means and standard deviations of random samples drawn from a normal, homogeneous population are independent. Does the same property of independence hold for yield data from agronomic experiments?

Fisher, Immer and Tedin (3)[1] studied the association between means and variances (k_1 and k_2) of 16 height measurements of barley plants selected at random from each of 24 plots having received different nitrogenous fertilizers. The covariance of k_1 and k_2 was -14.37 ± 13.27, a negative value but non-significant. Eden and Yates (2) used 32 height measurements from each of 8 blocks of wheat and found a negative covariance between k_1 and k_2, within blocks, of -187.26. A negative skewness was indicated in both studies due to what may be termed a ceiling effect tending to give smaller errors at the high end of the height range.

Arny and Steinmetz (1) obtained data on the yields of 10 square yard samples harvested from each of three replicated plots in a test of six fertilizer treatments. Seven such tests, with different crops or at different places, were carried out in exactly the same way. The mean yield and standard deviation of the 10 square yard samples was calculated for each plot. Means and standard deviations were then correlated, the correlation for the interaction of blocks×varieties, or error component, being used. This correlation would then measure the associations between means and standard deviations with the block and treatment effect eliminated. The results are given in Table I. In this, and other tables, $\bar{x}$ is used to represent the mean and s represents the standard deviation.

These correlation coefficients are based on 10 degrees of freedom each. Only one is significant, that of the first wheat experiment at

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[1] The numbers in brackets refer to the references cited on p. 531.

University Farm. Six of the seven coefficients were negative. The average correlation coefficient, obtained by transforming r to Fisher's z, averaging z and changing back to r, was −.291, a significant value. A tendency for plots of high yield to have a lower error than plots of low yield is evident in these tests.

TABLE I

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF PLOTS FROM DATA BY ARNY AND STEINMETZ

Place of Test	Crop	Mean yield in bu. per acre	Correlation of $\bar{x}$ and s
University Farm	Rye	25.57	−.530
University Farm	Wheat	35.82	−.614**
University Farm	Wheat	29.70	−.133
Morris	Wheat	18.91	+.521
Morris	Wheat	22.47	−.259
Morris	Wheat	28.34	−.474
Waseca	Barley	33.39	−.431
Average			−.291

** Highly significant.

Montgomery (7) provided data on 224 plots of wheat, from a uniformity trial, 5.5×5.5 feet in size. Combining these plots into groups of 8, to provide small blocks, the correlation between means and standard deviations from 28 such blocks was −.233. Mercer and Hall (6) published yields of 500 plots of wheat from a uniformity trial. Each plot was 1/500 acre in size. These were combined into blocks of 10 plots each and the means and standard deviations correlated. From these data the correlation coefficient was −.078. The correlation coefficients were negative in both cases but non-significant. These results are in accord with those obtained from data by Arny and Steinmetz (1) and with the results from height measurements reported by Fisher, Immer and Tedin (3) and by Eden and Yates (2).

Wiebe (8) published yields of 1500 rod rows of wheat in a uniformity trial. These data were grouped into 60 plots of 24 adjacent rod rows each. Ten such plots were taken as a block and the correlation obtained between mean and standard deviations of such plots within blocks. The coefficients of correlations are given in Table II.

The correlation within blocks, of +.480, is highly significant. The

TABLE II

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF PLOTS (24 ROD ROWS EACH) FROM WIEBE'S DATA

Variation	Degrees of freedom	Correlation of $\bar{x}$ and s
Between blocks	5	+.899*
Within blocks	54	+.480**
Total	59	+.590**

* Significant.
** Highly significant.

results from these data are not in accord with those previously referred to. Apparently the tendency toward a negative correlation between means and standard deviations of plots of the same material is not universal. A negative correlation might be expected, on theoretical grounds, and usually seems to be the case but exceptions to this rule may be expected.

Hayes and Immer (4) studied the association between mean yield and probable error in replicated rod row variety tests with cereal crops. They separated the varieties in the different experiments into three groups, viz., those falling within the low, middle or high third of the total range in yield of the varieties in a test. A separated error was calculated for each group within each test. Eight separate experiments were analyzed in this way. These comparisons involved about 450 strains of wheat in replicated yield trials, the probable errors being calculated between plots within varieties. There was a tendency for the probable error in bushels to increase and for the probable error in per cent of the mean to decrease as the yield of the varieties increased. Neither was constant.

Immer (5) studied the correlation between means and standard deviations of replicated rod rows, or small plots, of corn, barley, oats, flax and wheat. The mean and standard deviation were calculated separately for each variety in a given test. The correlation of means and standard deviations between varieties was then computed. It was concluded that as an average of all tests considered, involving 1087 strains or varieties, the standard deviation of these varieties was independent of the mean yield of the varieties. The data covered the range in yield encountered in practical variety trials in small plots.

In the study reported by Immer (5) the same 62 strains of wheat were tested at each of four stations in Minnesota in 1931 and 50 were tested at the same four stations in 1932. This permitted a further study of correlation between means and standard deviations from analyses of variance and covariance of the same strains in the four tests. The means and standard deviations calculated for each strain in each test were used for this computation. The results are given in Table III.

Only the total correlation is significant. The error correlation is slightly positive but non-significant. The correlation between varieties was very small and negative while the correlation between stations was high and positive. This latter correlation will be referred to later.

In 1932, 50 strains under test were compared in two separate experiments of 25 strains each, at the same four stations. The correlation coefficients for the different components of the variation are given in Table IV.

The correlation for error was negative in this comparison instead of positive as in 1931, but non-significant. The correlation between varieties was positive in 1932 and negative in 1931, being non-significant both years. The correlation between stations was +.642 in 1931 and −.676 in 1932. No generalization can be made for the association between means and standard deviations in different stations. Soil heterogeneity at one station will often be greater than at other stations. If the mean yields happen to be high at the station with inherently more heterogeneous soil this will tend to impart a positive sign to the correlation coefficient. If the mean yield at the same station were low, relatively, this station would tend to impart a minus sign to the correlation between stations.

TABLE III

CORRELATION BETWEEN MEANS AND STANDARD DEVIATIONS OF 62 STRAINS OF WHEAT TESTED AT EACH OF FOUR STATIONS IN 1931

Variations due to	Degrees of freedom	Correlation of $\bar{x}$ and s
Stations	3	+.642
Varieties	61	−.087
Error	183	+.114
Total	247	+.192**

** Highly significant.

TABLE IV

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF 50 STRAINS (TWO GROUPS OF 25) OF WHEAT TESTED AT FOUR STATIONS IN 1932

Variation due to	Degrees of freedom	Correlation of $\bar{x}$ and s
Stations	3	−.676
Groups of varieties	1	
Stations × groups	3	−.146
Varieties within groups	48	+.207
Error	144	−.029
Total	199	−.106

Other types of analyses were attempted also, using data from replicated variety tests with large plots (usually 1/40 acre). These data cover variety tests at six stations in Minnesota and for three different crops; namely, spring wheat, barley and oats. Randomized block analyses of variance were made for each test and the standard deviation for error; i.e., interaction of blocks × varieties, used as the standard deviation of the test. The general mean of the tests was then correlated with the standard error of the tests. The total number of such experiments available was 57 in spring wheat, 73 in barley and 73 in oats; a total of 203 variety tests in large plots.

At the four testing stations located at University Farm, Waseca, Morris and Crookston, data were available from tests for the same seven years in wheat, nine years in barley, and eight years in oats at all four stations. Analyses of variance and covariance gave the correlation coefficients between means and standard deviations of different tests which are shown in Table V.

TABLE V

CORRELATION OF MEANS AND STANDARD DEVIATIONS OF DIFFERENT EXPERIMENTS CONDUCTED AT EACH OF FOUR STATIONS DURING THE SAME YEARS WITH THREE DIFFERENT CROPS

Variation due to	Wheat		Barley		Oats	
	D.F.	r	D.F.	r	D.F.	r
Stations	3	+.785	3	+.446	3	−.084
Years	6	+.042	8	−.389	7	+.511
Error	18	+.122	24	+.129	21	+.061
Total	27	+.201	35	+.151	31	+.130

The correlation coefficients between the average means and standard deviations in the different years as an average of all stations were positive in the case of wheat and oats and negative for barley. None were significant. The correlation coefficients for the error component were small but positive for all three crops. The correlation coefficients between stations were +.78, +.45 and −.08 for wheat, barley and oats, respectively. While none of these are significant the trend is as expected from a knowledge of the general nature of soil heterogeneity at these stations. This may be shown by a comparison of the general means with the average standard deviation for these three crops at each station as in Table VI.

TABLE VI

AVERAGE MEANS AND STANDARD DEVIATIONS FOR EACH OF THREE CROPS

Station	Wheat		Barley		Oats	
	$\bar{x}$	$\bar{s}$	$\bar{x}$	$\bar{s}$	$\bar{x}$	$\bar{s}$
U. Farm	24.69	2.30	41.84	4.72	61.10	4.51
Waseca	24.84	2.29	48.88	4.85	69.73	5.82
Morris	22.57	2.19	35.80	3.15	57.12	5.39
Crookston	26.22	3.34	36.76	5.15	59.44	7.88

Soil heterogeneity at Crookston is greater than at the other three stations, leading to a high error. Crookston produced a higher yield of spring wheat than the other three stations but was next to the lowest in yields of barley and oats. As a consequence, Crookston tends to impart a positive correlation to wheat and a negative correlation to oats and barley, due to its inherently more variable soil.

It seems plain that it would be unwise to attempt to generalize regarding the association between means and standard deviations expected at different stations, even within the same state.

The average means and standard deviations for the data used in the analyses of these four stations are given in Table VII.

TABLE VII

AVERAGE MEANS, STANDARD DEVIATIONS AND COEFFICIENTS OF VARIABILITY OF THE TESTS CONSIDERED IN TABLE V

Variable	Spring Wheat	Barley	Oats
Mean	24.58 bu.	40.82 bu.	61.85 bu.
Standard deviation	2.53 bu.	4.47 bu.	5.90 bu.,
Coefficient of variability	10.3%	11.0%	9.5%

The standard errors in per cent of the mean were relatively constant for these three crops.

Since it does not seem possible to generalize regarding the error to be expected from station to station, it would seem of interest to consider the correlation between years within stations. Other tests not available for the analyses of variance and covariance used for Table V could then be used. These are tests from years in which data were available from less than a full complement of the four stations considered so far, as well as two other stations at which fewer tests were available, i.e., Grand Rapids and Duluth. Such correlation coefficients between years within stations are given in Table VIII.

TABLE VIII

CORRELATION OF MEANS AND STANDARD DEVIATIONS BETWEEN TESTS WITHIN STATIONS FOR THREE DIFFERENT CROPS

Crop	Degrees of freedom	Correlation of x and s
Spring wheat	50	+.394**
Barley	66	+.198
Oats	66	+.222

** Highly significant

The correlation in wheat was highly significant while the correlations for barley and oats were non-significant

In Table IX is given the range in standard deviations and coefficients of variability for the different variety tests of wheat, barley and oats conducted at six stations in Minnesota over a period of years.

Neither the standard errors in bushels (calculated from the error component of randomized block trials) nor the standard errors in per cent of the mean of the tests (C.V.) showed any appreciable degree of constancy in different years at the same station. Variability of the errors in different years is apparently very great.

In conclusion it may be said that from a consideration of the data presented here it appears that an inherent negative correlation exists generally between the mean yield of plots and the standard deviation of samples within such plots for uniformity trial data from field experiments. It appears also that the mean yields and standard deviations of varieties or strains of crop plants tested in replicated field experiments are essentially independent. It appears also very little correlation can be expected between means and standard errors of dif-

TABLE IX

RANGE IN STANDARD ERROR AND COEFFICIENT OF VARIABILITY OF VARIETY TESTS AT EACH OF SIX STATIONS FOR THREE CROPS

Crop and Station	Tests	Range in standard error	Range in C.V.
Spring Wheat			
Univ. Farm	14	1.50– 3.53	6.0–12.1
Waseca	11	1.71– 3.11	6.5–14.4
Morris	9	1.60– 2.84	6.9–15.1
Crookston	9	2.57– 5.11	8.6–26.8
Grand Rapids	9	1.32– 6.11	8.2–20.8
Duluth	5	1.51– 4.90	9.9–27.4
Barley			
Univ. Farm	15	2.70– 8.98	7.7–20.9
Waseca	15	3.29– 8.14	5.8–22.5
Morris	14	1.70– 5.08	4.8–14.7
Crookston	11	3.98– 7.54	8.0–24.6
Grand Rapids	11	2.54– 8.37	9.4–25.0
Duluth	7	2.83– 7.07	9.7–17.9
Oats			
Univ. Farm	15	2.42– 6.39	4.4–15.9
Waseca	12	2.70– 7.98	3.8–19.2
Morris	13	2.55– 7.17	6.3–11.5
Crookston	13	4.67–12.21	7.6–21.2
Grand Rapids	11	2.86–10.03	5.0–24.0
Duluth	9	5.37–15.20	8.2–28.2

ferent experiments conducted in different years or in different parts of the state, under the conditions of these experiments. Consequently, the standard deviation in bushels per acre as calculated from the separate tests would seem to be a more satisfactory measure of variability than would the standard error expressed in percentage of the mean. It was only in the comparisons of the average of the means and standard deviations of three different crops that the coefficient of variability would be preferred.

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NOTES

TEST OF AN OBSERVED DIFFERENCE IN THE FREQUENCY OF TWO RESULTS

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In the analysis of data obtained by sampling, certain problems occur which relate to the significance of apparent differences. Taking any pair of results to which a test may lead, and forming the difference of their respective frequencies observed in a sample, the question arises as to whether this difference is merely an accident of sampling, or whether a similar difference obtains in the universe. Thus if the possible results of a test are A, B, C, etc., A and B may be observed to occur in a sample with proportional frequencies p and p' respectively. If the probabilities, or proportional frequencies in the universe, of A and B are P and P' respectively, the question relates to the significance of the difference $p-p'$, or the extent to which it may differ from the true value $P-P'$.

To this problem there may be applied the same procedure as is used in estimating the significance of the individual frequencies themselves. On the hypothesis that the difference for the universe has some assigned value, there may be estimated the probability of a sample in which the difference deviates from its expected value by as much as that actually observed. If the probability of such a sample is very small, the hypothesis may be rejected, and the conclusion reached that the difference for the universe has some other value than the assigned one.

This is the method of approach employed by Prof. T. H. Brown in an outline of statistical methods adapted to studies of consumer preference.[1] To employ this method, it is necessary to evaluate the standard deviation of the distribution of differences and an expression for this quantity is derived in Prof. Brown's paper. As a preliminary to a discussion of his results, a derivation by another method of the expression for the standard deviation of the differences is given below.

The theoretical problem relates to the distribution of the difference $p-p'$ in samples of size N. Specifically, it is assumed that in the universe the probability of A is P and the probability of B is P'. Then the probability of a set of N trials in which A occurs just n times is given by the expression for the Binomial Distribution:

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[1] *The Use of Statistical Techniques in Certain Problems of Market Research.* Business Research Studies, No. 12, May 1935. Harvard University.

$$P_n(n) = \frac{N!}{n!(N-n)!}P^n(1-P)^{N-n}.$$

Out of the N trials there remain $N-n$ trials in which A does not occur, and in these the probability of B is $P'/(1-P)$. The probability of such a set of $N-n$ trials in which B occurs just m times, $P_{N-n}(m)$, is given by substituting m for n, $N-n$ for N, and $P'/(1-P)$ for P in the above equation. Then the probability of a set of N trials in which A occurs n times and B occurs m times is given by the product $P_N(n)$. $P_{N-n}(m)$, which may be written:

$$P(m, n) = \frac{N!}{n!m!(N-m-n)!}P^nP'^m(1-P-P')^{N-m-n}.$$

If now d is written for the difference $n-m$, the distribution of d is given by:

$$(1)\ P(d) = \sum_{n=0}^{N} \frac{N!}{n!(n-d)!(N-2n+d)!}P^nP'^{n-d}(1-P-P')^{N-2n+d}.$$

The arithmetic mean (D) of d is given by $\Sigma dP(d)$, so that by substituting the value of $P(d)$ given by (1) and reversing the order of summation there is obtained:

$$D = \sum_{n=0}^{N} \frac{N!}{n!(N-n)!}P^n \times$$
$$\sum_{d=n}^{2n-N} \frac{d(N-n)!}{(n-d)!(N-2n+d)!}P'^{n-d}(1-P-P')^{N-2n+d}.$$

By substituting $n-(n-d)$ for d, the second summation may be performed with respect to the variable $n-d$, to which correspond the limits 0 and $N-n$. In this summation the coefficient of n is the binomial expansion of $(1-P)^{N-n}$, while the term in $n-d$ reduces to $(N-n)P'$ multiplied by the binomial expansion of $(1-P)^{N-n-1}$. The remaining summation is similarly performed for the two terms, so that there is finally obtained:

$$(2) \qquad D = N(P - P').$$

The mean difference is therefore the difference of the means.

To evaluate the standard deviation a similar procedure is followed.

The value of $P(d)$ is substituted in:

$$\sigma_d^2 + D^2 = \sum d^2 P(d). \tag{3}$$

In this there is made the substitution:

$$d^2 = (n - d)(n - d - 1) - (2n - 1)(n - d) + n^2.$$

Making the summation with respect to $n-d$ first, as in the preceding case, the three terms on the right of the last equality are employed, the summation in each case being reduced to a binomial expansion. By carrying out the second summation in the same way, (3) is reduced to the form:

$$\begin{aligned}\sigma_d^2 + D^2 = N(N - 1)P'^2 - 2N(N - 1)PP' \\ + NP' + N(N - 1)P^2 + NP.\end{aligned}$$

Substituting in this the value of D given by (2) there is finally obtained

$$\sigma_d^2 = N\{P + P' - (P - P')^2\}. \tag{4}$$

It is of interest to compare this result with that obtained by Prof. Brown. He makes a distinction between cases of limited and unlimited choice, referring to whether the possible number of different results is small or large. In the latter case (unlimited choice) he assumes that in any sample the frequency of one result is independent of the frequency of the other result, and on this basis arrives at an expression for σ_d which reduces to:

$$\sigma_d^2 = N\{P + P' - (P^2 + P'^2)\}. \tag{5}$$

In the other case he does not make make this assumption of independence, and obtains an expression which reduces to (4).

It will be seen that the difference between (4) and (5) lies in the second (quadratic) term, and hence if P and P' are small, the difference becomes negligible and (5) is a valid approximation to (4). Prof. Brown's distinction between the two cases therefore reduces to a distinction between cases in which P and P' are both small, and cases in which they are not. This is a condition which is likely to occur when there are many different results to a test (unlimited choice), as no one result is then likely to have a high frequency (large value of P).

The distinction however, does not correspond in general to that between limited and unlimited choice. Cases may occur where many different results are possible (unlimited choice), but where one particular result occurs with high frequency. In any comparison involving this result with a large value of P, (5) will not be a good approximation. On the other hand, cases may occur where but three or four different results are possible (limited choice), but where two of the results occur very infrequently, so that in a comparison of these two P and P' are both small, and (5) is a valid approximation. In all cases, however, (4) is applicable and may be used without raising the question as to whether or not (5) is a satisfactory approximation.

In application, the observed difference in frequency in the sample may be compared with that which would be obtained if the difference for the universe had some assigned value. In particular, the hypothesis may be made that the difference for the universe is zero, and the hypothesis tested by determining the ratio of the difference of the sample to σ_d. Using Shewhart's rule, as Prof. Brown does, the hypothesis is rejected if this ratio is greater than 3. Conversely, there may be determined the least difference in the universe consistent with that observed on the basis of this or a similar rule. It should be noted that the use of this rule should be limited to cases where sample size (number of observations) is 100 or more.

The hypothesis that the difference for the universe is zero requires that P and P' be equal, or $P-P'=0$. Substituting this in (4), it remains necessary to estimate $P+P'$, and for this there may be taken the corresponding value observed in the sample, or $p+p'$. Prof. Brown, however, takes p and p' throughout as estimates of P and P' respectively, giving a somewhat smaller value of σ_d than corresponds to the hypothesis of a zero difference.

The application may be illustrated by solving the problem given as Problem 3 in Prof. Brown's paper. In this there are given the votes of 1168 housewives expressing a preference for one of four stores. The data are given by Prof. Brown as follows:

Store	*Votes*	*Per Cent*
Kirkland	671	57.5
Parker	311	26.6
Freeman	138	11.8
Manning	48	4.1
	1168	100.0

To determine whether the difference between Kirkland and Parker is significant, the observed difference (30.9 per cent) is compared with three times the standard deviation expressed as a percentage, or $300\sigma_d/N$ on the assumption of a zero difference in the universe (i.e. $P-P'=0$). As an estimate of $P+P'$ there is taken the combined vote for the two stores expressed as a fraction, or $0.575+0.266=0.841$. This gives a value for $300\sigma_d/N$ of 8.05 per cent, which is much less than 30.9 per cent, the observed difference. It is concluded that the difference is significant. Similarly in examining the difference between Freeman and Manning, $P+P'$ is taken as $0.118+0.041=0.159$, giving a value for $300\sigma_d/N$ of 3.50 per cent, which is again less than the observed difference, 7.7 per cent. Hence the difference between Freeman and Manning is also significant. These conclusions agree with those obtained by Prof. Brown, although his values of σ_d are, as explained above, somewhat smaller than those given here.

The illustration may be extended to cover a case such as might arise in practice in which it is desired not only to establish the existence of a difference, but to place some limit to its value. In the problem considered above, for example, it might be necessary to determine if the difference in percentage vote between Kirkland and Parker is significantly greater than 20 per cent. In this case, σ_d is obtained from (4) with $P+P'$ taken as 0.841 as before, and $P-P'$ taken as 0.20. This gives $300\sigma_d/N$ as 7.86 per cent so that the difference is significantly greater than 20 per cent if it is greater than 27.86 per cent. As the observed difference is 30.9 per cent this condition also is satisfied.

METHODS IN WILDLIFE CENSUSES*

Most forms of wildlife are so elusive, so really wild, and have so many hiding places, that the obtaining of anywhere near an accurate estimate of their numbers on any extensive area has proven exceedingly difficult. In fact, known methods have been so unsatisfactory that the Biological Survey has now detailed a research worker to the major problem of studying methods of taking censuses of wildlife. These difficulties of observation apply particularly to the mammals, many species of which den in hollow trees, among rocks, or in holes in the ground from which they are difficult to expose. Many of the larger species inhabit dense forests and are so wary that unless special means are employed they are rarely seen. So complicated is the taking of mammal censuses and so varying the habits of the different species that it is necessary to employ a different method for almost every group.

For several years the Biological Survey has conducted investigations in various parts of the country on beavers, as a part of which methods of determining beaver populations on a given tributary stream, slough, lake or large river have received attention. While no method yet devised is entirely dependable or infallible, yet several seem practicable and to offer possibilities. The old method of estimating by counting houses and bank burrows, and arbitrarily allowing five beavers to each domicile, tended towards overestimation. The error lies in that occasional single old male beavers leave the original colony and occupy quarters that would indicate the presence of a new colony, and young breeding pairs in establishing new colonies may not rear young until the following spring. In making censuses of beavers very important considerations are the temporary occupancy of houses and bank burrows, the interference by poaching or legal trapping, the effect of recent floods on destruction of beaver dams and on migration, and the distance from the home dam to available food supply.

Two methods of taking beaver censuses which have promise involve considerable detail but approach the desired accuracy. One of these, the use of live traps for the purpose of trapping to completion the individuals living in what appears to be one active colony, seems to be more accurate and dependable. The tagging or tail-marking as the animals are released prevents duplicating the count. Six traps under favorable conditions exhaust the colony in a few nights' trapping. Using a known number of active dams, houses, and bank burrows, and a given length of stream, and the trapped numeration from representative colonies, the enumerator can obtain a fairly accurate estimate for an entire watershed.

The other method can be used to advantage in restricted watersheds, where footprints show frequently in soft earth along stream banks, and sandy bars, where preliminary work on measuring the beaver's right hind footprint in millimeters affords a new census method. Several hundred measurements within an active colony shows by length variation the different individuals living there.

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* Prepared under the direction of W. B. Bell, Chief of the Division of Wildlife Research, Bureau of Biological Survey, United States Department of Agriculture.

On certain lakes, sloughs, and large rivers, the most practicable way of estimating numbers of beavers is to observe their activities at dusk from favorable vantage points. Late in summer and in fall, beavers are very active, and it is possible to count an entire colony at one time. Several evenings' observations give a fairly accurate estimate of the colony.

Live-trapping to exhaustion and marking all individuals so as to keep accurate tab of individuals, as recommended for beavers, is also adaptable to many small mammals, such as, for example, mice and shrews. It is often desirable to know the density of population of these inconspicuous animals in order to correlate their numbers with their economic importance, whether it be on the credit or debit side of the ledger. In the case of these small mammals, where the census area is usually comparatively small, marking of individuals is ordinarily accomplished by clipping off certain toes, which does the animal little harm and makes possible a surprisingly large number of combinations for markings.

Population estimates can be made quite accurately and very easily on certain species that build conspicuous nests, mounds, or shelters. The banner-tailed kangaroo rats of our Southwestern deserts make their dens by throwing up mounds of soil that range from 6 inches to 4 feet high and from 5 to 15 feet in diameter. Careful habit studies of this species have shown that only a single animal inhabits a mound except when young are present. A count of the mounds on a known area thus gives the number of kangaroo rats on the area. By this method 50 square miles of a Range Reserve was estimated to have a population of 64,000 kangaroo rats. It was further estimated that since each rat stored on the average of 4 lbs. of grass seeds and crowns and other forage annually, a total of 128 tons of edible forage was rendered unavailable for stock on this range.

Taking censuses of some of the so-called fur-bearers is important, but is often difficult and tedious on account of the general seclusion of these mammals. The most satisfactory results have been obtained by locating all the dens on a known acreage or square mileage, and then measuring in millimeters at each den the right hind footprints under favorable conditions of soft soil or snow to show tracks. This method usually tells not only the number of animals inhabiting the den, but often whether an adult male and female are present, and the number of young. It is particularly useful for such mammals as skunks, minks, badgers, otters, and foxes.

Jack rabbits live in open country and it has been possible to count them over a strip 500 feet wide from an automobile moving at 10 to 15 miles per hour. Several such counts in one region covered a lineal distance of 238.4 miles, the area covered was approximately 14,448 acres, on which 767 rabbits were recorded, or 0.053 per acre. Number of pellets on an area is in proportion to number of rabbits, and, while they give no absolute numbers, pellet counts are a reliable method of determining relative abundance of rabbits.

The counting of big game animals is somewhat expensive since it involves either the use of airplanes for counting from the air, or the employment of a considerable number of men for drives. Either of these methods when properly conducted, however, gives a fairly accurate estimate, but each must be employed under different conditions, the airplane for plains, open brushland, and winter deciduous woodland, whereas the drive is most efficient under cover of woodland, if not too dense.

Thus one can understand that the use of airplane would be more successful with such species as pronghorn antelope, bighorn sheep, mountain goat, buffalo, and under favorable conditions, particularly in winter, with deer, elk, and caribou. William H. Marshall, specializing on census methods for the Bureau, designates certain general points to be considered in using an airplane for census purposes:

1. Slow planes are desirable. Those with speeds higher than 90 miles per hour carry the observer over the territory too rapidly.
2. Low altitudes are essential. At 500 feet or less, one can see all the animals if the cover is not too dense and they are not too protectively colored. At 100 feet most of the animals start to move so that they may be seen readily, but this may be a disadvantage when there are large numbers since they mill around, the separate groups are lost sight of, and duplications in count are likely.
3. More than two observers are undesirable, because of possibilities of duplications.
4. A knowledge of the topography and plant cover of the country to be covered is essential.
5. The pilot should be informed in advance, insofar as possible, exactly what area is to be covered and how.
6. The observer should have had field experience with the animals to be censused.
7. Clear, still weather is desirable.

As an example of a detailed big game count made chiefly by airplane may be cited the following tabulation of the census of elk in the Jackson Hole region, Wyoming, made in the Spring of 1935:

Vicinity of Jackson, North of Jackson	452
Black Tail Butte	56
Buffalo River and Spread Creek	331
Sheep Mountain	388
River bottom, west of River, south of Wilson	104
River bottom, east of River, south of Jackson	117
Foothills, south of Jackson, to Horse Creek	264
Leeks Canyon	45
Game Creek	115
Squaw Creek	43

Porcupine Creek	254
Horse Creeks, not on feed ground	35
Hoback River, mouth to canyon	458
Hoback Canyon, to Van Vleck Ranch	188
Granite Creek, to Swift Creek	18
Cliff Creek and Sandy Marshall Draw	79
Fisherman Creek	3
Mount of Hoback, to Bailey Creek, East of Snake River	443
Bailey Creek to Bailey Lake	82
Willow Creek, to Hunter Creek	494
Alder Creek	7
Cabin Creek and Dog Creek	351
Canyon of Snake River, West side from Munger Mountain to Bailey Creek	290
Munger Mountain	496
Fall Creek and Coburn Creek	213
Gros Ventre	6,079
On Feed Grounds	10,630
Grand totals	22,035

All feed grounds were counted afoot, all other areas by plane.

Members of the Biological Survey, State Game Department and Forest Service took the census.

Airplane census made by F. Buchenroth, O. A. Pendergraft, Fred Deyo and Leo Laythe.

The report was signed by: A. C. McCain, Forest Supervisor; F. Buchenroth, Principal Forest Ranger; Almer P. Nelson, U. S. Game Management Agent, Biological Survey; and by Fred H. Deyo and O. A. Pendergraft, Assistant State Game and Fish Commissioners.

In making a "deer drive" count, among the first steps is to have a plant-cover type survey of the entire refuge or area, with known acres of each type. Representative plots of between 200 and 350 acres, and preferably triangular in shape, are selected from the various cover or game types for the counts, and after these are made the results can be apportioned to the total acreage and a fairly accurate estimate made of the number of deer on the refuge.

As many as 150 to 200 men are necessary for a deer drive, and the success of the drive depends a great deal upon the placing of these men and the care with which they operate. Men (watchers) are quietly placed according to visibility along two sides of the triangle. The drivers some 30 or 40 feet apart form a line in good formation on the third side of the triangle, and advance coming closer and closer together as they approach the apex of the triangle. Each man, watcher or driver, counts each game individual that passes him to the right and between him and the next man. If an animal returns within the triangle it is also counted as "in," so that the net count shows only animals originally within the area and actually driven from it.

In estimating bird populations and concentrations there are several methods that have been successfully used by the biologists and cooperators of the Biological Survey.

In the case of colonial nesting birds the method is obviously one of much simplicity since it is only necessary to count tle occupied nests and (since very few of such birds are polygamous) multiply by two. This obviously does not take into consideration the nonbreeding birds that may be present in the colony but for most species the numbers of nonbreeders that will frequent a nesting colony is relatively few.

In the spring of 1914 the Survey started an inquiry for the purpose of determining the number, distribution and relative abundance of the breeding birds of the United States. This investigation was confined almost exclusively to the nongame species, chiefly the passerine birds. The actual work was done mainly by volunteer cooperators. While sometimes, because of local conditions, it was desirable to have a count made over a large area, ordinarily it was found desirable to keep the areas surveyed within a tract of not more than 80 acres. On an area of this size one observer could during the nesting season actually count the birds with considerable exactness. The method followed was to count the singing males during the height of the nesting season, it being assumed that every singing male represented a pair of birds. The ecological type of the area surveyed is, of course, an important part of the report, as such areas were intended merely as samples.

In work with migratory waterfowl two methods have been used with considerable success, one based entirely upon visual observation and the ability of the observer to accurately estimate distances, while the other involves a mathematical computation based on the relation that appears to exist between the number of ducks banded and the number of those killed during the first succeeding hunting season.

The first of these two methods was worked out in 1922 under exceptionally favorable conditions at Crane Lake, Illinois. The birds involved in the original study were almost entirely mallards. Briefly, this method consists of estimating in square yards the area that may be covered by a concentration of ducks, allowing one duck per square yard and then to allow for the raft end taperings and open spaces within the formation to subtract one-third from the figure obtained. Obviously, the success of this method depends entirely upon the ability of the observer to estimate the length and breadth of the formation. It has, however, been checked on two different occasions through the application of aerial photography, once on mallards and once on canvasbacks. In both instances the results tallied so well with the original estimate as to demonstrate the reliability of the method for all practical purposes.

The second method is, of course, purely a matter for office technique. In May 1930, the Bureau published as Circular No. 118 the results of the study that was then possible. It should be borne in mind that the data then used were based upon the continuous open seasons of 90 days that had preceded this period. At that time it was found that the first year recovery percentage was between 11 and 13 per cent and on this figure it was postulated that if we might obtain a reliable estimate of the total number of ducks killed in any one shooting season it would, by a simple mathematical formula, be possible to estimate the waterfowl population for that season. Since that time we have had shooting seasons of at least two types and of different lengths which obviously has a disturbing effect upon the figures and it also appears that there are other factors which must be brought into the picture.

In the midwinter inventory work that has been conducted for the past three years the first of these methods, namely the estimate of raft concentrations, has been chiefly the one employed.

Perhaps the most common method that has been in use by Biological Survey employees and cooperators is that of estimating the units of a flock, or units of birds on the water, and computing the total number in a flock on that basis. This is an old method and it has been and still is being used by a great percentage of the people who have been making bird counts for the Bureau. With the flock in motion, it is absolutely impossible for the majority of people to make area estimates and compute birds, on that basis. One, however, can divide off units and count those birds in the units, and then compute the total.

PROGRESS OF WORK IN THE CENSUS BUREAU

BEGINNING PREPARATIONS FOR THE SIXTEENTH CENSUS

Under the existing law, and in the absence of any new legislation changing the date, the next decennial census will be taken as of April 1, 1940. Realizing that it is none too soon to begin preparing for this undertaking, the Bureau of the Census has obtained a small appropriation to be used for that purpose during the current fiscal year. One of the first things to be done is to establish enumeration districts covering the entire inhabited areas of the United States. For this purpose and also for the guidance of enumerators and supervisors when engaged in taking the census, maps are needed showing political divisions, streams, railways, roads, etc., on a scale of about one inch to the mile. For a large part of the United States adequate maps are lacking. Government surveys cover adequately only about 26 per cent of the total area. Thus far the Bureau has obtained maps covering about 1,200 of the 3,091 counties in the United States. There were 120,003 enumeration districts in the last census and, of course, with the growth of the population, there will be many more in 1940.

A list of institutions is being prepared in order that each institution may be assigned to the proper enumeration district or made a separate district in itself as conditions may require. There are about 30,000 institutions.

A CLASSIFICATION OF WORKERS BY SOCIAL-ECONOMIC STATUS

In the reports of the Census Bureau the gainful workers enumerated in the population census are regularly classified by their occupation or the kind of work in which they are engaged; and occupations are distributed under a few main divisions of the industrial field, such as agriculture manufactures and mechanical industries, trade, etc. The census of 1930 included also a classification by industries, in which the criterion is not the kind of work done, but the industry in which the worker is employed. There is a considerable demand and use for still another grouping based not on what the worker does nor on the industry in which he works, but on his social-economic status as indicated by his occupation. Certain studies, prepared in the Census Bureau, have already been published giving a grouping of that character; and the Bureau is now preparing a report showing this grouping for the workers classified by industries or services. It distinguishes six main groups as follows: Professional persons; proprietors, managers and officials; clerks and kindred workers; skilled workers and foremen; semi-skilled workers; unskilled workers. There is a subdivision of some of these groups. The group of unskilled workers distinguishes farm laborers, factory and building construction laborers, other laborers, and servant classes; and the group of proprietors, etc., distinguishes farmers, wholesale and retail dealers, and other proprietors. These social-economic groups will be shown for each of the 128 industries or services distinguished in the industrial classification of gainful workers; and the members of each group within the industry or service will be distributed by color, nativity, sex, and age. The report gives only totals for the United States. But in the meantime the National Resources Committee has prepared a report classifying by the same social-economic groups the gainful workers in each state and each city of over 500,000 inhabitants with a further classification by color, nativity, and sex, but not by age nor by industry or service.

The material for the Bureau's report has gone to the printer and will be printed in type making a volume of about 250 octavo pages.

JUDICIAL CRIMINAL STATISTICS

The report on judicial criminal statistics for 1935, now in the hands of the printer, will be the fourth annual report in that series since the Bureau, under an Act of Congress passed in 1931, began collecting these statistics.

The basic data are derived from the records of the courts of general criminal jurisdiction in the several states. These are the courts which have the power to try and dispose of felony cases. Unfortunately for statistical purposes, there are wide variations in their jurisdiction, which in some states is limited mostly to major offenses while in others it may include such misdemeanors as disorderly conduct and violations of driving and parking laws.

This lack of uniformity interferes seriously with the comparability of the statistics by states. For instance, the fact that in 1934 the percentage of convictions resulting in a prison sentence ranged from 5.8 per cent in Wisconsin to 69.4 in Colorado is mainly accounted for by the fact that in one state 74.4 per cent of the cases reported by the courts were minor offenses, while in the other state the corresponding percentage was only 23.4. To meet this situation the comparative analysis by states in the 1935 report will be based on that portion of the cases reported which have been classed as "major offenses," although data for all other offenses will be given in other connections.

The data for this inquiry are supplied on tally sheets which are filled out by the court clerks as one of their regular duties. They work under the supervision of some state official who examines and approves their returns. This method of obtaining the data is inexpensive, but in other respects is not altogether satisfactory. It has been found that much of the detail called for is not being accurately reported by the court clerks, and it may prove necessary to simplify further the tally sheets. It is planned to do some experimental work in individual case reporting. But to adopt that method would probably require an increased appropriation, which it is not easy to get in these days.

The work at present covers 31 states. This includes all the Northern and Western states, except Missouri, and Nevada.

A CENSUS OF PUERTO RICO

A census of Puerto Rico covering population and agriculture was taken as of December 1, 1935, under the auspices of the Puerto Rico Reconstruction

Administration. The tabulation of the data and the preparation of the reports were under the immediate direction of the Chief Statistician for Population in the Bureau of the Census.

Three bulletins, with text in English and in Spanish, will be issued. The first bulletin, presenting statistics of population for the island as a whole and for each municipality, barrio, city and town, for 1935 and 1930, with certain comparative figures for earlier censuses, was published December 3, 1936. The other two bulletins will be issued early in the fall, one giving the composition and characteristics of the population, including data on families, occupations, and unemployment, and the other, detailed statistics of agriculture.

AN ADVISORY COMMITTEE ON FINANCIAL STATISTICS OF CITIES

A special advisory committee for the Division of Financial Statistics of Cities has been established comprising the following members appointed by the Secretary of Commerce: Frederick L. Bird, Municipal Service Department, Dun and Bradstreet, Inc., New York City; Welles A. Gray, United States Chamber of Commerce, Washington, D. C.; A. M. Hillhouse, National Committee on Municipal Accounting, Chicago; Dan O. Hoye, City Controller, Los Angeles; and Charles J. Fox, City Auditor, Boston.

The first meeting of the Committee held in Washington last June, was devoted mainly to a survey of the work of the division. The committee, however, went on record as urging strongly the renewal of the collection of financial statistics of states, which was discontinued in 1932.

J. A. H.

STATISTICAL NEWS AND NOTES

Central Statistical Board.—A book of charts of time series, selected on account of their significance for economic stabilization, is under preparation for the National Resources Committee by members of the staff of the Central Statistical Board. The book will contain some 200 charted series reflecting cyclical fluctuations in important phases of business activity and related changes in other aspects of our society.

Each page of charts will be accompanied by a page of text material discussing, first, the significance of the charted series; secondly, the principal virtues and defects of the series in comparison with other available data; and thirdly, objective specifications for each series. It is intended by careful selection to provide a broad picture with a limited number of series. The chartbook should be of service not only to Government agencies but also to students of economic and social conditions outside of the Government, and should fill an important need. It is hoped that the book will be available in October.

Dominion Bureau of Statistics, Canada.—*1936 Census of the Prairie Provinces*. The final tables for the volume on population of the three Prairie Provinces are well under way. The compilation of the agricultural census is almost completed. Unemployment, employment and earnings tabulations for cities of 10,000 population and over are compiled and preliminary figures are available. Final tables are expected to be started before the end of this month.

The monograph on "The Rural and Urban Composition of the Canadian Population" has reached an advanced stage in preparation and it is expected it will be ready for publication in the near future.

Social Analysis Branch. At the Conference on International Relations (Carnegie Endowment), which was held at Queen's University, Kingston, June 14 to 18, 1937, three papers were read by members of the staff of the Bureau of Statistics. Dr. R. H. Coats gave the paper entitled "Movements of Population between Canada and the United States." The Chief of the Social Analysis Branch read the paper on "United States Born in the Professions in Canada," and the Chief of the Internal Trade Branch delivered the paper entitled "Movements of Capital and Balance of Payments."

Manufactures Branch. This Branch is at present compiling statistics of weekly wage payments to wage-earners in the manufacturing industries of Canada. This is a new development and the report is expected to be published in the autumn. It will contain such wage payments by sex and wage groups analyzed by industries, provinces, cities, and towns.

Certain difficulties have been encountered in applying the ruling that net value of production should be computed by subtracting the cost of materials and also the cost of fuel and electricity from the gross value of products. The Forestry Branch reports that in connection with the pulp and paper, lumber and wood-using industries a large proportion of their fuel consists of wood wastes which has already been purchased as part of their raw material and that its use as a fuel should not be subtracted a second time from the gross production when so used. The policy has been adopted of adding the value of such wood waste used as fuel to the gross production. This results in treating this wood waste as a fuel sold by the reporting firm to itself. The same procedure is adopted in the petroleum industry where petroleum produced by an individual firm and used as a fuel in their plant is added to their gross production.

Education Statistics Branch. The Bureau of Statistics, through the Education Statistics Branch, was represented at the Canadian Universities Conference held May 31 to June 1, 1937, at Queen's University, Kingston, Ontario. The Conference instructed its Executive to appoint a committee to study university statistics during the coming year as the foundation of future policy.

Finance Statistics Branch. The Hon. W. D. Euler, Minister of Trade and Commerce, has called a Conference at Ottawa, which will open on July 19, to discuss the subject of municipal statistics. Representative delegates from the Departments of Municipal Affairs of each province, as well as representatives of the City Treasury Departments of the larger cities in each province, will meet with representatives of the Dominion Bureau of Statistics and formulate plans to bring about coordination and publication of uniform municipal statistics throughout Canada.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM.—The Board of Governors of the Federal Reserve System has revised its monthly index of freight-car loadings. The revised series, like that formerly published, is based on the weekly figures of the Association of American Railroads and is compiled both with and without adjustment for seasonal variation. The total index is derived by weighting indexes for the various classes of commodities on the basis of revenue obtained from each class rather than by adding the actual number of carloads as was done in the previous index. The purpose of this change is to allow for differences among commodity classes in the importance of the average carload. The revised index is described on pages 522 and 523 of the *Federal Reserve Bulletin* for June 1937.

Statistics on loans at weekly reporting member banks in 101 leading cities are now published in the *Federal Reserve Bulletin* for the more complete loan classifications that became effective May 19, with the new items also grouped to give figures closely comparable with data previously reported. A detailed comparison of the old and new loan classifications was given on pages 530–531 of the June issue of that *Bulletin.*

The twenty-third Annual Report of the Board of Governors of the Federal Reserve System, which was issued in June, contains a discussion of outstanding credit and business developments, reports of the operations of the Federal Reserve System, and records of policy actions of the Board of Governors and of the Federal Open Market Committee in the year 1936.

The most important recent development for the Federal Reserve System was the increase in reserve requirements of member banks made by the Board of Governors in 1936 and the early part of 1937. Reasons for this action are fully discussed in the report, and there is also given a brief statement of the history and purpose of reserve requirements. The large gold and international capital movements in recent years, which have caused a rapid increase in member bank reserves, are described and analyzed in the report. Other sections deal with the continued growth of bank credit and deposits, developments in security markets, including the Board's actions with regard to margin requirements on security loans, and the further recovery of business.

The complete edition of the Annual Report, containing statistical tables and other detailed information relative to the Federal Reserve System, was issued later in the summer.

SECURITIES AND EXCHANGE COMMISSION.—During its third fiscal year, ended June 30, 1937, the Securities and Exchange Comission has continued to expand the scope of its statistical activities. Again only a small part of the material collected has been released for publication. The more important statistical data released during the year ended June 30, 1937, (for statistics released before that date see this JOURNAL, September, 1935, pages 608–609· September, 1936, page 578) included:

(1) Figures on purchases and sales of certain groups of members of the New York Stock Exchange and New York Curb Exchange have been released weekly on a daily basis since March, 1936, and are published about one month after the transactions occur. Comparable data for the period from June 27 to December 18, 1935, were contained in the Commission's Report on the "Feasibility and Advisability of the Complete Segregation of the Functions of Broker and Dealer." A summary of the weekly releases through March, 1937, with corrections as received from the exchanges, was made available in the Public Reference Rooms of the Commission's Washington office and of its principal regional offices. Thus, there is now available a continuous daily record of members' trading on the New York Stock Exchange and the New York Curb Exchange since March, 1936.

(2) In June, 1937, the Commission commenced to make available daily at the Washington office figures showing for the second day preceding that of the release, the number of shares purchased and the number of shares sold in odd-lots by odd-lot dealers and specialists on the New York Stock Exchange, together with the number of orders involved in such trades. These figures are reprinted in the financial pages of many daily papers. Weekly summaries of these figures, as corrected by more complete reports from the odd-lot dealers, and expanded to include the value of daily purchases and sales in odd-lots, are made available to the public in release form.

(3) The comprehensive statistical data on investment trusts and investment companies collected in connection with the Commission's study, authorized by the Public Utility Act of 1935, have been prepared for pub-

lication, at least in part, in the Commission's forthcoming report to Congress. Combined balance sheets, income accounts, and security portfolios of groups and sub-groups of investment trusts and investment companies constitute the most voluminous part of the statistical compilation.

DIVISION OF RESEARCH AND STATISTICS, FEDERAL DEPOSIT INSURANCE CORPORATION.—The Annual Report of the Federal Deposit Insurance Corporation for the year ending December 31, 1936, has been issued. The report follows the style and form of previous reports and shows that the Corporation met promptly all insurance claims presented to it by depositors in 75 insured banks placed in receivership from the beginning of deposit insurance to the close of 1936 (pages 8–9), and made loans to facilitate mergers and reduce loss to the Corporation in the case of 28 insolvent insured banks (pages 9–12). The Corporation has met all losses and paid all expenses out of income from investments and has transferred to surplus all assessments received (pages 34–37).

More than 140 weak or insolvent insured banks were eliminated during 1936 through suspensions, mergers, liquidations or reorganizations (pages 8–12). Up to the close of 1936 the Corporation cited 24 banks for unsafe and unsound practices, specifying more than 50 such practices in which the banks had engaged (pages 16–19).

More than one-tenth of the insured banks, holding more than one-fourth of the deposits of insured banks, had less capital than the Corporation deems essential (pages 27–28, 51–55). Of the banks authorized to establish branches during 1936, one-third, holding more than $3 billion of deposits, had insufficient capital (pages 25–26).

Earnings of banks improved substantially during 1936 (pages 55–57). On the average the small banks reported higher net earnings on each $100 of total assets than did the large banks (pages 58, 172–73). The small banks, furthermore, show a higher ratio of sound capital to deposits than do the large banks (pages 52–53).

Deposit insurance and the banking system have not yet been tested sufficiently to justify a reduction in the rate of assessment (pages 34–38).

The report contains considerable statistical information not heretofore available for presentation, regarding the number and deposits of operating insured and noninsured commercial banks, grouped according to type of banking office; by size of bank, as measured by amount of deposits; by population of center in which located; and by number of commercial banking offices in same center. The reports for the year 1936 of earnings, expenses, and disposition of profits of insured commercial banks not members of the Federal Reserve System are presented as tabulated on the basis of size of bank; number of banking offices in and population of center in which located; profitability of operations; and types of assets and liabilities.

A report on deposits of insured banks as of May 13, 1936, based upon a special survey made by the Corporation, is also presented.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.—An analysis of world production and trade in leather footwear was issued by the Bureau in July. This publication is prepared as a service to the boot and shoe industry and presents a series of data for both leather and rubber footwear, of value to those groups. Statistical data is shown covering the production, consumption, imports, and exports for the nations of the world. The subject of artificial trade barriers, such as quotas, compensatory imports, exchange restrictions, exchange fluctuations and British Empire preferences, is discussed with particular reference to the effect of these barriers on the leather footwear industry.

The Marketing Research Division of the Bureau is publishing by states a list of state and local trade associations. These lists, in addition to showing the names and addresses of each association classified by cities in which they are located, present pertinent data from the 1935 census for that state. Free copies of these lists can be obtained from the District Offices of the Bureau located in the principal cities throughout the United States or directly from the Marketing Research Division in Washington.

Due to the considerable amount of attention being devoted to the subject, this Division has also issued a bibliography of publications on consumer cooperatives. This bibliography is representative of the best material available on this subject. All *Journal* readers interested in obtaining a copy of this bibliography may secure it by writing the Marketing Research Division of the Bureau of Foreign and Domestic Commerce, Washington.

The Bureau's study of "Consumers Use of Selected Goods and Services by Income Classes" has been expanded to include data from approximately 230,000 families located in 50 cities which are well distributed, geographically, throughout the United States. This study is based on individual family income reports for 1933 and the family's use, during 1934, of such products as building materials, househeating apparatus, mechanical refrigerators, installed bathing facilities, fuels for lighting, heating, and cooking, automobiles, and so on; and, the facts given apply to innumerable related products such as ice refrigerators, ranges, electrical appliances, and paints. To date reports are available for 34 cities, and the next report, which will be issued in the fall, will cover the remaining cities. Copies of the reports as well as a list of the cities covered can be secured from the Bureau or any of its offices.

A report giving statistical data, on a county basis, for each of the major groups in the pulp and paper industry, both by types of product and by manufacturing machinery in place, has recently been issued. The report is the fourth in the Bureau's series covering basic industrial markets of the United States. Those previously published cover Textiles, Iron and Steel, and Gas and Electric Utilities Industries. The present volume contains 77 pages of text and tables with 12 accompanying maps.

Another Bureau study of interest is a complete survey of the "Effects of City Water and Sewerage Facilities on the Market for Air Conditioning Equipment in Cities of 100,000 Population and Over." This is the first time that data on the water supply facilities of major cities has been gathered. The report shows the source of city water supply, the amount of reserve water upon which the city may draw, the amount actually used over a 6-year period, the additional services that may be had with the present equipment, together with other basic information, all of which has a direct effect upon the value of each of these cities as a potential market for air-conditioning equipment.

A series of maps of the United States, based upon 1935 retail trade data, has been appearing in *Domestic Commerce*. These maps are designed to show retail sales, per capita sales, concentration of retail stores by types of enterprise, marketing centers, rural sales, and market distances. These maps will be reprinted and distributed by the Marketing Research Division.

In July the Specialties Division published an analysis of "Japanese Production of Glass and Glass Products" and their exports of such items. A similar study for all of the Latin-American countries will be issued in the early fall. Both studies discuss the possible future development of trade in this commodity.

For the first time a comprehensive study of the foreign graphic arts industries is being made by the Bureau. This study, in addition to discussing the major branches of graphic arts in about 70 countries of the world, will point out the potential markets for products of the graphic arts and for equipment, supplies, and machinery used in their production.

BUREAU OF AGRICULTURAL ECONOMICS.—Last year Dr. A. G. Black, Chief of the Bureau of Agricultural Economics, set up a Bureau Statistical Committee to examine the statistical work of the Bureau and make recommendations for its improvement. After obtaining information from the various divisions regarding statistical series compiled by the Bureau, subcommittees were established to review the data relating to various phases of the Bureau's work. The study of the subcommittees' reports is now in progress. Some of the recommendations of the committees have been approved by Dr. Black and have been transmitted to division leaders in a series of statistical memoranda, of which six already have been issued. One of these provides for concentration of responsibility for acreage, yield, and production estimates of domestic crops. Others call for the elimination of annual farm income estimates on a crop year basis, the approval before issuance of new statistical series by the Chief of the Bureau upon recommendation of the Bureau Statistical Committee, the clearance of proposed questionnaires through a Questionnaire Clearance Committee, and more careful examination before publication of statistical series not originating within the Bureau. In general, the amount of duplication in the compilation of statistical series was found to be smaller than might have been expected in an organization of this size, handling upwards of a million separate statistical series, but many opportunities for improving the reliability and adequacy of Bureau statistics seem to be present.

In the June 1937 issue of the "Agricultural Situation" Dr. Mordecai Ezekiel published a brief summary of an estimate of savings by individual income taxpayers which was recently prepared, together with a discussion of the apparent relation betwen these personal and corporate savings and the production of durable and non-durable goods. This preliminary examination is held by the author to support in general the oversavings theory of business depressions. It is expected that the details of the preparation of Dr. Ezekiel's estimates of savings will shortly be published in one of the professional economic journals.

Secretary Wallace has appointed a committee for the Department of Agriculture to consult with the Census Bureau with respect to the United States Census of Agriculture for 1940, as has been customary in connection with past decennial enumerations. The committee has received recommendations from the various bureaus of the Department, and after editing designed to eliminate duplications and reduce the number of questions, has transmitted them to the Bureau of the Census. The Agriculture Committee of the Bureau has held joint meetings with the Department committee for the purpose of ironing out difficulties preliminary to the preparation of a trial working schedule which will be given field tests before the final schedules are prepared.

U. S. BUREAU OF MINES.—The canvass of the mineral industries for 1935 was a cooperative effort under which the Bureau of Mines collected the information utilizing funds supplied by the Census of Business. In addition to the usual items elected by the Bureau of Mines, the canvass included questions covering the Census inquiries on value of product, expenditures for supplies and materials, fuel, and purchased electric current, and the number and compensation of both wage earners and salaried employees. Other information obtained included wage earners employed by months. Preliminary figures for all important mineral commodities have been issued in mimeographed form by the Philadelphia office of the Census of Business. Final figures including detailed state tables on bituminous and anthracite coal will be released in booklet form by the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques of the Works Progress Administration. A second booklet summarizing important employment and related data for petroleum, metals, and nonmetals (excluding fuels) is in preparation.

Studies entitled, "Technology and the Mineral Industries," by F. G. Tryon, T. T. Reed, K. C. Heald, G. S. Rice and Oliver Bowles, and "Small-scale Placer Mines as a Source of Gold, Employment and Livelihood in 1935," by C. W. Merrill, Chas. W. Henderson and O. E. Kiessling, have been released in May and June. These reports were made possible by a cooperative arrangement between the Bureau of Mines and the Works Progress Administration's National Research Project. The cooperative arrangement provides for a series of studies on relationships between changes in mineral technology and output per man. O. E. Kiessling, Chief Economist of the Mineral Production and Economics Division of the Bureau of Mines, is in charge of these joint studies; F. G. Tryon, Chief Economist of the Bureau's Coal Economics Division, is supervising the work on the coal industries as well as consulting on other phases of the analysis.

BUREAU OF RESEARCH AND STATISTICS, SOCIAL SECURITY BOARD.—Administrative organization of this Bureau follows the main functional lines delegated to the Social Security Board under the Social Security Act. Ewan Clague is Acting Director, succeeding Walton H. Hamilton, who has been named Special Economic Consultant to the Social Security Board and to the Bureau. Thomas C. Blaisdell, Jr., is Assistant Director. The Administrative organization comprises: Division of Public Assistance Statistics, Helen R. Jeter, Chief; Division of Public Assistance Research, Chief to be appointed; Division of Unemployment Compensation Statistics, William McCaw, Acting Chief (on temporary assignment to the Bureau of Unemployment Compensation), Robin Hood, temporarily in charge; Division of Unemployment Compensation Research, Louis Bloch, Chief (on temporary assignment to the Maritime Commission), Collis Stocking, Acting Chief; Division of Federal Old-Age Benefits Studies, Eleanor L. Dulles, Acting Chief; Division of Health Studies, I. S. Falk, Chief; Service (Administrative) Division, Ernest R. Burton, Executive Officer, Chief; Division of Economic Studies, Chief to be appointed. Activities of the divisions are to be coordinated by three assistant directors. Mr. Blaisdell is charged with this responsibility for the Divisions of Public Assistance Research and Statistics and the Division of Economic Studies. At the present time Mr. Clague is acting in this capacity for the Divisions of Unemployment Compensation Research and Statistics, and Mr. Falk for the Division of Federal Old-Age Benefits Studies and Health Studies.

A multigraphed monthly bulletin, *Selected Current Statistics*, is prepared by a committee of the Bureau staff to report data on current operations under the Act and certain basic economic data in the field of social security. Preparation of the sections of this bulletin is the responsibility of the respective divisions concerned with the subject matter. Intended primarily for use by the staff of the Board, this bulletin is now available to state administrative organizations in the field of social security, and in some cases to other individuals concerned with the subject.

Among current activities of the divisions are the following:

Division of Public Assistance Statistics. A note in the March issue of this JOURNAL outlined the organization of this Division and the general scope of its activity. On April 1, as detailed below, this Division assumed complete responsibility for the collection of general relief statistics, while reports on relief in rural areas will be received by the Division beginning with those for July. In the April issue of the bulletin, *Public Assistance, Monthly Statistics for the United States*, the Division started regular reporting of total public relief, comprising general relief, public assistance, wages under the Works Program, and payments under other major public programs.

Statistics of Public Assistance under the Social Security Act: Monthly statistics on old-age assistance, aid to dependent children, and aid to the blind are reported to the Social Security Board by cooperating state agencies. These data are published in monthly and quarterly bulletins and in two mimeographed releases. Data for April 1937 and estimates for May and June appeared in a mimeographed release on June 1. *Public Assistance, Monthly Statistics for the United States*, containing data for April, was published on June 14.

General Relief Statistics: Upon the advice of the joint Advisory Committee on Relief Statistics of the Works Progress Administration and the Social Security Board, the entire responsibility for the collection of relief statistics was transferred to the Social Security Board as of April 1, 1937. Complete data for 26 states and partial data for 14 states were published in the April bulletin which was released on June 14. Data for January, February, and March will be published jointly by the Social Security Board and the Works Progress Administration in the monthly bulletin entitled *General Relief Statistics*.

Relief in Urban Areas: The series of relief statistics from public and private agencies in 116 urban areas, formerly published in the United States Children's Bureau and transferred to the Social Security Board on July 1, 1936, is continued in a new monthly publication of the Social Security Board entitled *Relief in Urban Areas*. The first number covering data for January 1937 was published on May 15; the second, containing data for February, was published on June 8.

Relief in Rural Areas: Progress has been made toward the transfer of the series on relief in rural areas and small towns from the Works Progress Administration to the Social Security Board. Through joint field work on the part of the two Federal agencies, the collection of data now has been transferred from the direct responsibility of WPA employees in most states to the responsibility of the state department of public welfare. The Social Security Board will begin to receive reports from these state departments for the month of July and will continue the montly publication entitled *Current Statistics of Relief in Rural and Town Areas*.

Total Relief in the United States: Another effort to present the entire situation with regard to public relief in the United States is being made in the monthly bulletin, *Public Assistance, Monthly Statistics for the United States*, where all of the data available from reports of the Works Progress Administration were brought together for April 1937 with those of the Social Security Board. The forthcoming issue for May 1937 will contain data from the Resettlement Administration also.

Social Data about Recipients of Public Assistance: The Division has revised slightly the forms and instructions for the collection of social data about persons accepted for public assistance during the fiscal year 1937–38.

The collection of these data for 1936–37 will be completed by the states on June 30 and the Social Security Board will receive completed tabulations on August 1. It is expected that an important body of information about more than a million cases will be ready for presentation in the Social Security Board's annual report to Congress on January 1, 1938.

Division of Federal Old-Age Benefits Studies. This Division is carrying on a number of studies dealing with the economic and financial problems and effects of the old-age benefits program. The significant statistical data resulting from the old-age benefits wage records will also be analyzed by this Division.

Among the fields in which studies are being carried on are: cost of the old-age benefits program together with the relation of this cost to national income; the incidence of pay-roll taxes under Title VIII and their effects on wages, employment, etc.; the relationship between various benefit formulae and standards of living; and the effects upon the Old-Age Reserve Account of bringing additional groups of employees under the Act. Other studies deal with the effect of business cycles upon the reserve and the economic problems involved in building up and liquidating the funds so held; the effect of Social Security financing upon future trends in interest rates and investment; the differences in economic and social effects resulting from a contributory and non-contributory system of old-age benefits; and an analysis of the extent and mechanisms of savings by income classes together with the forms of investment and liquidation of savings, particularly in different phases of the business cycle.

A sample of about eleven and one-half million persons, taken from the enumeration of employee applications for Social Security account numbers, is now being analyzed with reference to the age, sex, and race composition of the population group with whom the old-age benefits program will be concerned. Further studies bearing on quarterly and annual earnings and employment by numerous categories will be carried on as the regular wage reports from employers are received.

Division of Unemployment Compensation Statistics. By June 17, 35 states and the District of Columbia had installed the industrial classification code approved by the Social Security Board. In most of the other jurisdictions and states, laws have been passed too recently to permit this step. This industrial coding system makes provision for one hundred major industrial groups covering all economic activities. During the latter part of this year, a system of sub-classification within each major industry group will be issued. In general, two digits indicating classification have been included in the employer's number in the ledger accounts of state unemployment compensation agencies.

This system will enable the Social Security Board and state unemployment compensation agencies to secure comparable information on a state and nation-wide basis on subject employers, covered workers, earnings subject to contributions, contributions, delinquencies, and benefit payments, by industry. In addition, information of the status and solvency of funds available for benefit payments may be secured by industry groups. This latter information, coupled with data on the expansion and contraction of employment by industry may shed light upon the question of merit rating by industry groups. At the present time, steps are being taken to incorporate the system of industrial classification in conjunction with Federal old-age benefits as a means of obtaining statistical information by industry.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR.—There is now in press a bulletin reviewing the history of strikes in the United States, and bringing together all the statistical data available from 1880 to the end of 1936. There is also included a brief account of the methods used in the collection and interpretation of strike statistics by the Department of Labor and by the Bureau of the Census in earlier years.

Material collected in the urban study of consumer purchases is being published in a series of brief reports by cities, giving detailed statistics on sources and amount of family income, rentals paid by families of business, professional, clerical, and workers' families, and the proportion of families owning their own homes. These special reports are being issued in advance of the more comprehensive report on consumer purchases in general.

In connection with its regular monthly reports on "Trend of Employment and Pay Rolls," the Bureau has secured fairly comprehensive data on earnings and employment among clerical workers in manufacturing establishments. These data are now being tabulated and the completed report will show the changes in volume of employment and earnings in identical establishments in January, June, and December, 1935, and in June and December, 1936.

The special survey of causes of accidents in a small sample of the construction industry has been followed by a similar study of causes of accidents in the fertilizer industry. This newly initiated research in a field which has been very little explored will be continued during the current year and it is hoped to enlarge the coverage. Concurrently the regular accident reporting for the Bureau's annual surveys of accident statistics is being increased in coverage from 7,000 to approximately 50,000 manufacturing establishments. Also, the number of industries covered is being increased from 30 to 50, including public utilities.

The work of redistributing the rent sample used by the Bureau in its cost-of-living surveys has been completed in 8 representative and widely distributed cities and will be completed for 6 additional cities by September. Rental data for the new sample are being collected for all price-reporting periods from March 1935 to date. The retail price section has also classified retail prices of coal according to sizes.

A survey of wage rates actually paid to union and non-union construction industry employees has been completed. Payments are shown by occupation, race, and degree of skill of workers, and by city. The data are assembled for residential and nonresidential and public and private building. A summary of the results will appear in the *Monthly Labor Review* and a more detailed report will be issued later in bulletin form.

UNITED STATES EMPLOYMENT SERVICE.—Work on a detailed survey of the characteristics and distribution of over 5 million persons, who were actively registered with offices of the United States Employment Service in search of work during July, is now nearing completion. This survey, which is similar in nature to several previous inventories of the Employment Service active file, discusses the occupational and industrial classifications of the workers, the age, sex, color, and geographical distribution. A report also will be included of the registration and placement activities of the Employment Service during the three months of April through June.

A similar study was made as of April 1st, and a new one is proposed to be prepared analyzing the job-seekers registered during October.

At the present time the Worker-Analysis Section is conducting research in five different occupations. Preliminary results have warranted a continuation of the study of department store salespersons and a third sample is now being studied. Standardization of selection procedures for card punch operators, coders, garment machine operators, and lamp shade sewers is in process. Oral trade questions for jobs in the foundry industry, machine shops, lumber and woodworking industry, hotels, restaurants, and mechanical service and repair industry are in the process of verification. Questions for jobs in the construction industry have been verified and are now in use in certain public employment offices.

DIVISION OF SOCIAL RESEARCH, WORKS PROGRESS ADMINISTRATION.—*Current Statistics of Relief in Rural and Town Areas.* The monthly indexes of expenditures for six types of relief in rural and town areas, prepared by the Division of Social Research, have been computed back to January 1932. Data are reported currently for 385 areas in 36 states. State welfare agencies in each state have now assumed responsibility for the reporting series. Work is in progress on a bulletin concerning the five years of rural relief covered by the series.

Youth Estimates. The Rural Research Unit has made estimates of the youth population (16 to 24 years of age) of the United States from 1930 to 1952. The method used is the application of the probable mortality rates to the persons of various ages listed by the Census in 1930 who would fall in the 16 to 24 year age group in subsequent years. For persons born in 1925 or thereafter the annual number of registered births was used. These estimates show that, in so far as numbers may be an index of the severity of the youth problem, the peak will be reached between 1940 and 1945. The number of rural youth in 1935, by states, has also been estimated.

The Migratory-Casual Worker. This recently issued monograph is based on interviews and the 1933 and 1934 work histories of casual laborers in agriculture and industry. The monograph considers the nature of the workers and their jobs, the economic and personal factors which lead to migration, typical migration patterns, the substandard economic position of the workers, their needs, and the prospects of improving their economic and social status in the future.

Labor Shortage Studies. The Division has attempted to develop procedures for a quick type of survey which will obtain information for administrative use in the shortest time and most systematic manner possible. These procedures were used during the period of seasonal demand, for cannery and farm labor, when numerous investigations were made of reported labor shortages alleged to be the result of relief policies. No shortages due to relief policies were found. The difficulties in securing labor were largely due to a wage scale below the prevailing rates in other industries, and to the seasonal character of the work. Other studies were made in northern New England of the shortage of woodsmen, which was due to an unusually high demand for labor. Very few experienced woodsmen who would be acceptable to employers were employed on WPA projects or were receiving local relief.

Publications Under Cooperative Plan of Rural Research. Under the Cooperative Plan of Rural Research, more than 150 bulletins prepared by the State Supervisors of Rural Research have been published or approved for publication. These reports deal primarily with various aspects of the rural relief situation in individual states. They are available at the state agricultural experiment stations. States for which bulletins have been issued include: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Illinois, Iowa, Kentucky, Louisiana, Maryland, Minnesota, Missouri, Montana, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, and Wisconsin.

Survey of Public Assistance Extended to Households in the Drought Areas. A 100 per cent enumeration was made of all households receiving aid in 64 sample counties in 10 Great Plains States from July 1 through December 31, 1936. Tabulations are now in progress. One of the primary objectives of this study is the determination of the amount of duplication of relief activities among households receiving public assistance in the drought area.

The publications of the Division not previously listed are as follows: *Urban Workers on Relief, Part II—The Occupational Characteristics of Workers on Relief in 79 Cities, May 1934;* and *Current Statistics of Relief in Rural and Town Areas, for February–March 1937 and for the Years 1932–1936; and also for March–April 1937.*

In addition, work is in progress on monographs, now in manuscript form, which deal with the cost of living in 59 cities, relief benefits under the FERA, trends in relief expenditures 1910–1935, part-time farming in the southeast, migrant families, changing aspects of urban relief, changing aspects of rural relief, rural youth on relief, the rural family in the depression, the village and the depression, industrial and educational backgrounds of workers on relief in March, 1935, and legislative aspects of public welfare.

DIVISION OF RESEARCH, STATISTICS AND RECORDS, WORKS PROGRESS ADMINISTRATION.—*Works Program Statistics.* With the beginning of a new fiscal year, certain changes are being made in the statistical reporting system of the Works Progress Administration. The changes are dictated both by the reduced level of Works Program operations contemplated during the coming year and by the experience gained in two years of statistical reporting. Consideration is being given to consolidation of some of the twelve area statistical offices established for the tabulation of primary operating documents from which the reports are derived. Substantial reduction of the personnel in these offices has been accomplished. Further use of mechanical tabulating equipment is likely.

Report forms have been subject to careful review. The semi-monthly employment reports have been discontinued as has been the monthly Works Program employment report by county of residence of the worker. Data on employment, hours, and earnings continue to be obtained on a monthly basis by location of project operation. Attention has been directed toward a closer integration of statistical reporting and the requirements of Works Program administration both in the states and in the central office.

The June 1937 issue "Report on the Progress of the Works Program" summarizes operations under the Works Program through May 31, 1937, and includes discussions of employment, funds, projects, and other information of general interest.

A *History and Evaluation of Work Relief through 1935* is nearing completion.

A study is under way in the Construction Statistics Section to examine the nature and cause of seasonality in construction employment. The report of the President's Conference on Unemployment, published in 1924 under the title "Seasonal Operations in the Construction Industry," contended that custom, not climate, was the major cause of such seasonal unemployment, and further that changes in construction technology were causing an increase in winter employment. Statistical materials already examined fail to offer support to these contentions.

A report by this section which includes estimates of total dollar volume of construction and construction employment has been completely revised. The revised figures show employment by sources of funds and types of construction. Employment estimates show the high, low, and average for each year since 1925, through 1936.

The Labor Research Section has completed extensive tabulations of available information concerning hourly wage rates paid in public and private construction for 25 occupational groups during 1936. These data cover approximately 1,000 different communities in the United States. A second series of tables showing hourly rates, monthly hours of work and monthly earnings on WPA work projects for eight important occupations has also been completed. These data cover every county in the United States as of December 31, 1936.

Relief Statistics. From September 30, 1936, until the last of April, 1937, the work of obtaining, compiling, and analyzing for publication reports of general relief administered by state and local governments was performed by a joint office of the Works Progress Administration and the Social Security Board. The professional staff consulted with the Advisory Committee on the Collection of General Relief Statistics on matters of policy and also questions of technique and procedures. (See March and June issues of this JOURNAL.)

At the end of April an agreement was reached between the Works Progress Administration and the Social Security Board for the transfer of complete responsibility for national reporting of general relief statistics to the latter agency. This transfer involves the continuation of all work in connection with the collection of monthly data previously reported to the Federal Emergency Relief Administration on relief recipients, amounts of relief extended, and administrative and total costs of general relief. The regular monthly releases of these data are being continued as joint publications of the Social Security Board and the Federal Emergency Relief Administration throughout the first quarter of 1937 and thereafter will be continued in equivalent form by the Board. The Board will continue efforts in all states to retain and improve the coverage and quality of, and to expedite the submission of, current and delinquent general relief reports. Changes in instructions to the state relief agencies regarding the preparation of reports or the discontinuation of any items previously reported will be cleared with the Central Statistical Board and the Works Progress Administration before such action is taken.

The Advisory Committee on the Collection of General Relief Statistics will continue to serve in the same capacity as under the joint arrangement between the two agencies. Miss Helen R. Jeter, Director of the Division of Public Assistance Statistics, has been designated by the Social Security Board to take the place of Ewan Clague on the Committee. Other members of the Committee are Ralph G. Hurlin, Chairman, Frederick F. Stephan, Paul Webbink, and Emerson Ross.

With the consummation of this agreement, members of the staff of the joint office of the Advisory Committee on the Collection of General Relief Statistics returned to the statistical divisions of the agencies which had furnished their services during the interim arrangement. Certain work which was under way at the time the joint staff was liquidated is being carried on by a small technical group in the Works Progress Administration under the immediate direction of Thomas B. Rhodes, who has served as Secretary of the Advisory Committee. This work includes a review of all available statistics of relief activities of Federal, State, and local governments with a view to the possible integration and periodic publication of such data.

The first step in the direction of the regular publication of data for all relief programs was the issuance by the Works Progress Administration of a bulletin entitled "Summary of Statistics of Relief in the United States in 1936." This publication received wide distribution at the National Conference of Social Work held in Indianapolis in the last week of May 1937.

National Research Project, Works Progress Administration. Previous issues of this JOURNAL have carried outlines of the work undertaken by this Project. In other pages of the present issue will be found reports of meetings respectively of the Philadelphia and the Washington chapters of the American Statistical Association at which the research program of the Project, as well as methods, problems, and some preliminary findings, were presented by various members of the Project's staff.

As of July 1, the following reports have been released: "Unemployment and Increasing Productivity" and "Technology and the Mineral Industries" (prepared as chapters in a forthcoming publication of the National Resources Committee entitled *Technological Trends and their Social Implications*); and "Small Scale Placer Mines as a Source of Gold, Employment and Livelihood in 1935."

Reports in press include the following: "Employment and Related Statistics of Coal Mines in 1935," "Changes in Labor, Equipment, and Methods Used in Producing Sugar Beets," "Length and Changes in the Farm Work-Day," and "Mechanical Cotton Harvesting."

WOMEN'S BUREAU, U. S. DEPARTMENT OF LABOR.—The Women's Bureau made a study, during the first three months of 1937, of earnings and hours worked by men and women in the woman-employing industries of Florida. A total of almost 28,000 employees in 265 establishments were included. A preliminary report has been released in mimeographed form and the final report is now being prepared.

At the request of the District Committee of the House of Representatives, the Women's Bureau made a survey of the hours and wages of women workers in the chief woman-employing industries in the District of Columbia. The survey was conducted in March and April of 1937. About 200 establishments were covered and pay-roll records obtained for over 12,500 women. The industries surveyed included factories, department, limited-price and ready-to-wear stores, laundries, cleaning and dyeing plants, beauty shops, hotels, and restaurants. No attempt was made to cover Government service or household employment, and offices were not surveyed but data concerning office workers in the various industries covered were secured and these have been reported separately. A preliminary report has been released in mimeographed form and the final report will soon be available from the printers.

METROPOLITAN LIFE INSURANCE COMPANY.—The Statistical Bureau of the Metropolitan Insurance Company announces the publication in early fall of a volume entitled *Twenty-five Years of Health Progress*, a study of the mortality experience among the Company's Industrial policyholders covering the 25-year period, 1911 to 1935.

Represented here is the experience of 346½ million years of life in the wage-earning population of the United States and Canada. During the quarter century over 3 million deaths were recorded. From the record of these deaths, analyzed by sex, color and age, has come a well-defined picture of the remarkable progress of medicine and public health in the two countries within the quarter century.

The volume offers an orderly presentation of the trends that have taken place in the mortality from each of the more important causes of death, and the factors influencing the broad movements of the death rates. Such developments as the control of tuberculosis and the improved treatment of diabetes, pernicious anemia, and other diseases, particularly those of children and young adults, are clearly outlined in this study. In a special chapter is described the relationship between the decreasing mortality and the increasing average length of life.

Meticulous care has been taken to insure the accuracy of the information presented. Not only has modern statistical technique been used in analyzing the raw material derived from the death claims, but the death claims themselves have been carefully checked and verified.

The chapters are as follows: The General Mortality from All Causes, The Trend of Longevity over the Twenty-five Year Period, The Principal Communicable Diseases of Childhood, Tuberculosis, Influenza and Pneumonia, Cancer, Cardiovascular-renal Diseases, Diabetes, Diseases of the Puerperal State, Miscellaneous Diseases of Relatively Minor Importance, and External Causes of Death. In addition to over 500 pages of text, the study includes about 75 pages of basic tables and an ample index.

INDUSTRIAL RESEARCH DEPARTMENT, UNIVERSITY OF PENNSYLVANIA.—In appreciation of the research in commodity prices which has already been done by the Industrial Research Department, the Wetherill family has recently given to the University of Pennsylvania all of its records. This collection, which is housed in the Department, begins with a day book in 1762 and traces the development of the business which was started by Samuel Wetherill and which was in the Wetherill family for seven generations. eventually being known as Wetherill & Brother. The majority of the records trace the founding and growth of the first firm to manufacture white lead in this country; the remainder of the collection includes the records of other enterprises in which the Wetherills were interested at various times: a store, a chemical works, a glass factory, a textile mill, and anthracite mining. The possession of these records by the Department has a two-fold significance: (1) it facilitates future work on the analysis and interpretation of this unusually comprehensive collection of business records; (2) it furnishes the nucleus for the future development of a library of original documents tracing the economic growth of Philadelphia.

The Industrial Research Department of the Wharton School of Finance and Commerce of the University of Pennsylvania has published through the University of Pennsylvania Press a third volume on the subject of commodity prices in Philadelphia—"Wholesale Prices in Philadelphia—Part II: Series of Relative Monthly Prices," by Anne Bezanson, Robert D. Gray, and Miriam Hussey.

These detailed tables are the source materials of Part I of the volume which studied the price behavior of 186 commodities during the significant period of seventy-eight years of American business activity. The material in this part represents the data from which the group, sub-group, and summary totals were obtained, and can be used in comparisons with commodity prices of other areas or with other data of Philadelphia. The prices for over two hundred specifications are expressed in terms of their average monthly prices of 1821 to 1825. The absolute base, and the unit in which it is quoted, is given for each commodity, and adequate footnotes make clear any changes in description. A few pages of explanatory text precede the tables.

NATIONAL INDUSTRIAL CONFERENCE BOARD.—The Board's Division of Industrial Management continues its studies of industrial and labor affairs by the questionnaire method. "Personnel Practices Governing Factory and Office Administration" recently issued is a statistical summary of what is done in 788 manufacturing establishments, employing upwards of one million wage earners, and 453 concerns with upwards of 300,000 clerical workers, regarding innumerable details of procedure. It answers for the personnel department of any concern the question what other establishments are doing under like circumstances. The Division has under way an investigation of wage differentials in which, by means of questionnaires, it will seek to show the existing wage differentials for specific occupations as well as for industries as a whole.

The Board has utilized the *Ministry of Labour Gazette's* recently published figures for earnings and hours to establish for selected industries "Workers, Earnings and Hours in Great Britain" a comparison with the figures collected for the United States Bureau of Labor Statistics. For the Chemical Alliance the Board has under way an extensive statistical study of labor conditions in the chemical industry. This will be distinguished by the effort to secure classified information regarding the annual as well as weekly earnings of wage earners and the weekly earnings of salaried employees.

In the field of public finance, the "Cost of Government in the United States, 1934–1936" carries forward a series which has become known as the most authoritative collection of data regarding state and local expenditures, tax collections and debt. A useful compendium of "Sales Taxes," state, Federal, and local has been issued. The Department of Public Finance is engaged in a study of "Experience under the Undistributed Profit Tax." A study of "Chain Store Taxes" will be published shortly.

The study of the "Economic Development of Germany under National Socialism" is replete with statistical analysis of conditions in modern Germany. It is the first of a series of practical studies of collectivism. It is proposed to take up shortly conditions in Italy and Soviet Russia, the Board sending, as in the case of Germany, an experienced investigator to those countries to assemble the material at first hand.

In the field of general economics a study of "International Raw Commodity Price Control" is well advanced towards completion. This study includes an exhaustive statistical analysis of raw material and foodstuffs prices in international markets, in original and United States currencies, in relation to visible supplies as well as in relation to control measures.

The publication of new data necessitated a review of the Board's unemployment studies. The result of this study "Revised Estimates of Employment and Unemployment" is accompanied by "Notes on Methods of Estimating Employment" which should be of interest to workers in this statistical field.

The volume "Income Received in the Various States, 1929–1935" mentioned in the last issue of this JOURNAL is now ready. It gives for each state an estimate of the amount of income arising from each industrial source, and the amount of income of each type. Income studies for different branches of activity such as iron and steel manufacturing and the motor vehicle industry are being prosecuted, and other phases of the national income will be studied in the future.

CHAPTER ACTIVITIES

The Albany Chapter.—There was a meeting of the Albany Chapter on May 6, 1937. Dr. Roy Gillett presented a brief report for the Committee on Coordination of State Statistics. Dr. A. K. Getman presented a brief discussion of managed currency. The principal address of the evening was given by Dr. Mordecai Ezekiel, Economic Adviser to the Secretary of Agriculture, on the subject, "A Statistician's Responsibility for a Better Ordered Economy."

The Chapter held a dinner meeting at the Candle Light Inn on June 10, with Dr. W. W. Coxe, President, in the chair. Thirty members and guests were present. The following officers were elected for the ensuing year: President, Fred J. Decker, New York State Department of Civil Service; Vice-President, Roland F. Bucknam, Public Service Commission of New York; Directors, Edward H. Van Winkle, Rensselaer Polytechnic Institute, and Marjorie Gooch, New York State Health Department.

Dr. V. B. Hart of the staff of the Department of Agricultural Economics and Farm Management at Cornell University gave a very instructive talk on the subject of "Gold and Prices."

The Boston Chapter.—A special meeting of the Boston Chapter was held on May 7, 1937, at the office of the United Business Service. There were 32 present as guests of the United Business Service, which organization provided a very enjoyable buffet supper. Prior to the supper those present had an opportunity to observe the commodious offices and modern equipment in the five-story remodeled building occupied by the Service.

At the speaking session, Mr. Frederick F. Stephan, Secretary of the American Statistical Association, spoke briefly with reference to "Recent Developments in Statistical Work and the Participation of the Association Therein."

Dr. Lucile Eaves, Professor Emerita, Simmons College, Boston, gave an address on "Discrimination in Employment Against Older Wage-Earners." Dr. Eaves has made a thorough study of the results of a recent report on this subject by the Massachusetts Department of Labor and Industries, and has written a review of the report, which was published by the United States Bureau of Labor Statistics in the *Monthly Labor Review* for June, 1937 (pages 1359–1386), which review includes statistical tables and charts to which she referred in her address. The report was the basis for an Act passed by the Massachusetts Legislature and approved by the Governor on May 27, 1937, entitled "An Act Prohibiting Discrimination Against Certain Persons in Employment on Account of their Age."

The Chicago Chapter.—At the annual meeting of the Chicago Chapter held on April 26, 1937, the following officers were elected for the coming year beginning October 1: President, John H. Noble, Armour and Co.; Vice-President, Henry B. Arthur, Swift and Co.; Secretary-Treasurer, Miss

Frances Hay, Standard Oil of Indiana; and Directors: H. B. Stair, Illinois Bell Telephone Company; Dr. T. O. Yntema, University of Chicago; and W. B. Ricketts, Booz, Fry, Allen and Hamilton. Membership of the Chapter as of the annual meeting totaled 128.

THE CINCINNATI CHAPTER.—The newest chapter of the family in the national organization was granted a charter in May of this year. As a local organization, however, the group dates back to 1934, when Dr. F. E. Wolfe (now president), Professor W. A. Baude and Dr. Paul Horst (both now on the executive committee), and Dr. Albert K. Kurtz (now in New Haven) met together and decided that a statistical group was needed in Cincinnati. They invited their friends. Since then, the group has met five to seven times each year.

This spring the group realized that it had grown beyond the bounds of an informal organization. The members wanted the stimulation of an organic relationship with the national association, and they wished to cooperate with the work of the larger body. Accordingly, a constitution was adopted, vesting control in an executive committee composed of the president and the two immediately past presidents, and a petition was submitted to the American Statistical Association for a charter as a chapter. The petition was approved in May by the Board of Directors of the Association.

The first meeting held by the group in its new role as an official chapter of the American Statistical Association was led by the secretary and district representative, Douglas E. Scates, on May 13. Dr. Scates read a paper on "Methods of Combining and Averaging Product-Moment Correlations."

The programs for the meetings held by the local group during the past winter are as follows: Robert D. Kahl, "Statistical Methods in Sales Analysis," March 25, 1937; F. E. Wolfe, "What Does Homogeneity Mean?" February 25, 1937; Paul Horst, "Prediction with Allowance for Errors in the Independent Variables," January 14, 1937; and Ellery F. Reed, "Statistical Methods in Social Case Work," October 22, 1936.

THE CLEVELAND CHAPTER.—The Business Statistics Section of the Cleveland Chapter spent an interesting afternoon on April 26 at the Nela Park offices of the General Electric Company.

On May 20 the tenth annual meeting of the Chapter was held at the Cleveland Chamber of Commerce Club. 55 members and guests were present. President L. M. Whittington presided. Dr. Frank T. Carlton was elected President and Mr. John W. Love, Vice-President, of the Chapter for 1937–38.

Three papers were presented at the meeting. Mr. David C. Elliott, Chief Statistician of the Reconstruction Finance Corporation and a former member of the Cleveland Chapter, spoke on "Changes in the Spending Habits of Business." In a study of data from 150 manufacturing concerns, Mr. Elliott concluded that in view of the backlog of orders inventories are not burdensome at present. While inventories were 90 per cent higher in 1936 than in 1935, a 15 per cent gain after an adjustment for higher prices and 14 per cent higher than in 1929 after an adjustment for price changes, new orders are greatly in excess of last year. Mr. Elliott discussed next the effect of the new surtax on undistributed profits on the cash positions. He discovered that while net earnings have been less than in 1929, dividends have been higher. He found that the increase in net working capital was small in 1936 and that some new financing may be necessary to bolster the cash position. The data showed that the cost of sales has been rising somewhat more rapidly than sales, but he concluded that the trend is not important with rising business.

Agnes Brooks Young, Regional Director of the Fashion Group, discussed the results of her study of "The Recurring Cycles of Fashion." Mrs. Young's original purpose had been to discover the relationship between fashions and the business cycle. Her results forced her to abandon any idea of correlation. Her study for the more recent times was based on measurements and styles appearing in the fashion magazines. Separate tabulations were shown for skirts, waists, collars, sleeves, etc. The talk was illustrated with slides. The discussion of the recurring cycle of skirt styles from tubular to bell shaped to back flare and back to tubular was particularly interesting.

Mr. Merle Hostetler, a lecturer on banking and finance at Cleveland College spoke on the "Turning Points in Business Cycles." His talk was based on a large folded grid which showed the cyclical fluctuations of industrial production by months over the past century. Numerous notes were included on the grid to explain the cyclical movements of the curve. The notes included comments on legislation, price trends, banking and finance, important inventories, major disasters, political events, etc. Copies of the grid were distributed among the guests for reference during the address.

THE CONNECTICUT CHAPTER.—A meeting of the Chapter was held on April 19. Mr. Robett Parnall, Manager of the Hospital Service Fund of New Haven spoke on "Statistical Bases of Hospital Service Plans."

THE NEW YORK DISTRICT CHAPTER.—One hundred and fifty members of the Association met at the Aldine Club on the evening of May 28 for a discussion of the economic effects of fiscal policies. The principal speakers were Sir Josiah Stamp, Dr. Carl Snyder, and Colonel Leonard P. Ayres. Dr. W. Randolph Burgess presided.

The subject of the evening's discussion was the economic effects of fiscal policies. Mr. Stamp introduced his remarks with a brief description of the difference between the incidence and the effects of taxation. He discussed the increasing use of taxation to influence economic activity and analyzed the immediate and long-term effects of taxing undistributed profits. Colonel Ayres discussed a number of popular opinions with respect to government, economics and business, which the people of the United States have been taught to believe and which have guided the fiscal policy of the present Administration. Mr. Snyder discussed the effects of the redistribution of wealth in a socialminded civilization upon the continued growth of capital. An extended general discussion followed.

The first meeting of the Public Health Section of the New York Chapter was held on June 15th at the Town Hall Club in New York City. The subject under discussion was "Mortality Connected With Childbirth." Dr. John L. Rice, Commissioner of Health was the presiding officer and the speakers included: Dr. John Collinson, Assistant Chief Statistician for Vital Statistics of the U. S. Bureau of the Census; Miss Katharine F. Lenroot, Chief of the U. S. Children's Bureau; Miss Elizabeth C. Tandy of the U. S. Children's Bureau; Dr. Herman Bundesen, President of the Board of Health of Chicago; Miss Hazel Corbin, Director of the Maternity Center Association of New York City; Dr. George W. Kosmak Editor of the *American Journal of Obstetrics and Gynecology.*

Dr. Collinson discussed the inconsistencies that exist between the statistics of various countries and how the comparability of their rates is affected and pointed out that to obtain comparability between nations, definitions must be made uniform, and coding and classification must be standardized.

Miss Lenroot reported on the activities of the Maternal and Child Health Division of the U. S. Children's Bureau and discussed recommendations made to the Bureau which cover increased and improved maternity care and care of the newborn, and a program of training in these fields for physicians and nurses.

Dr. Bundesen spoke on the important factors responsible for failure further to reduce infant mortality and stressed the fact that if the health officer is to do anything in the way of preventing neonatal deaths he must first be able to measure the problem. He reported on 500 autopsies which were performed on infants in Chicago and explained in detail how the assigned causes of the neonatal deaths were corrected after autopsy.

Miss Tandy reported on the Children's Bureau study of stillbirths which is being made with the cooperation of the Committee on Stillbirths and with more than 216 hospitals. It is believed that rules can ultimately be worked out which will supply the ground work for statistical information on a nation-wide scale with respect to the fetal and maternal conditions underlying mortality from stillbirths. Miss Tandy presented a number of charts to the group which showed graphically the results of the preliminary analysis of the material gathered so far.

Miss Corbin told of what is happening in New York City where half of the mothers receive no care at all until after the sixth month of pregnancy. She spoke of the overcrowding in the municipal hospitals and reported that 3,475 women were delivered in their homes by midwives. Miss Corbin briefly outlined a plan which would save women from the humiliation of shopping around for doctors to deliver their babies at a price which they could afford to pay.

Dr. Kosmak spoke from the point of view of the obstetrician and said that though 50 per cent of the puerperal deaths are avoidable, the desire for painless labor, for short cuts in delivery, and for sacrifice of safety to comfort have all had a bearing on our high rates. Dr. Kosmak noted that there is hope for obstetrics if we can develop a closer bond of appreciation between the art and the science of this branch of medicine, and the statistician should interpret his findings in the best interest of the mothers and the medical profession.

This first meeting of the Public Health Section was attended by 85 people interested in statistics and maternity and infant welfare. While no definite plans have been made as yet, it is hoped that there will be another meeting of this group in the fall.

The program committee consisted of: Miss Jessamine S. Whitney, Chairman, Mary Augusta Clark, Thomas J. Duffield, Dr. Hugo Muench, Dr. W. Frank Walker, and Mrs. Helen Slade, District Representative.

THE PHILADELPHIA CHAPTER.—The last meeting for the season for the Philadelphia Chapter was on Friday, May 7th, and concerned "Studies in the Impact of Technological Change in Employment."

Mr. David Weintraub, Director of the National Research Project of the Works Progress Administration, spoke briefly on the general problems involved.

Mr. Irving Kaplan, Associate Director of the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques, spoke about the research program. Dr. Harry Jerome discussed the "Place of Individual Plant Histories in a Productivity Survey." Mr. J. A. Hopkins spoke concerning "Trends in Employment in Agriculture and Basic Causes as Exemplified by Data for the Corn Crop." Dr. Gladys L. Palmer of the Industrial Research Department, University of Pennsylvania, described briefly the studies of the Philadelphia labor market which are being conducted by the National Research Project in cooperation with the Industrial Research Department of the University of Pennsylvania. These papers were presented at a later date to the Washington Statistical Society. They are reported on pages 571–577 of this JOURNAL.

At the annual business meeting, the following officers were elected for the ensuing year: President, Dr. Hiram S. Davis, Department of Industrial Research, University of Pennsylvania; Vice-President, Dr. Parker Bursk, Wharton School, University of Pennsylvania; and Secretary, Mr. Robert D. Gray, Department of Industrial Research, University of Pennsylvania.

THE PITTSBURGH CHAPTER.—The Pittsburgh Chapter met on April 30 to hear a discussion by Mr. D. Walton Matthews, President of Bondex, Incorporated, of New York City, on "Handling a Bond Account in Accordance with Economic Trends." Mr. Matthews emphasized the importance of a comprehensive classification of bonds according to their credit rating and according to their reactions to changing economic conditions.

At a meeting of the Chapter on May 27 Mr. Calvin E. Cohen, Field Representative of the U. S. Treasury Department, spoke on "Differences in

Sentiment between the East and the West." His address was primarily related to the issue of "Baby Bonds" and the differences between the East and the West in the popularity of these bonds.

On June 1 the Chapter met with the Hungry Club to hear Dr. Harold G. Moulton, President of the Brookings Institution, speak on "Are Shorter Hours, High Wages, and Public Works a Cure for Unemployment?"

THE SAN FRANCISCO CHAPTER.—At a meeting of the San Francisco Chapter on April 22, 1937, Mr. Adalbert Wolff, Investment Analyst, Brush-Slocum and Company, spoke on "Investment Analysis." In considering the purchase of a security, he pointed out that it is necessary to consider the general economic situation, the attractiveness of the industry in question, the position of the company in the industry, and finally its financial record and present state. The remainder of the discussion was directed toward the last of these considerations.

The speaker thought that ratio analysis is of little value for the comparison of industrial companies since their requirements differ, but it may be of excellent advantage in ascertaining the progress of one company over a period of years. Ratio analysis is much more useful in comparing companies in the case of railroads, utilities, banks, or fire insurance companies, and often makes it possible to determine *earning power*, the most important element the common stock should possess.

Similarly, undue emphasis is often given to book value, but book value itself is usually no criterion of actual value. Balance sheets naturally are of prime importance, since they reveal the current position and capital structure of the company. The earnings statement provides a dynamic picture and should be compared item by item with statements of previous years. Statistical or financial analysis presents a view of the company's past operations and present condition, but it cannot provide a dependable answer as to what may be expected of the company in the future. At most, it can lay a foundation for a judgment which must include a broader investigation of the company's position in the industry, the outlook of the industry itself, and general economic conditions.

Dr. Norman J. Silberling in discussing Mr. Wolff's paper called attention to the difficulty encountered by the financial statistician and analyst because the data provided by the usual financial manuals are not strictly comparable from year to year. This work would be greatly facilitated if the manuals provided adjusted figures over long enough periods to afford really significant comparisons and trends for at least the long-established companies. Attention was also called to the deceptive character of the price-earnings ratios as a test of security values, since prices of common shares tend to anticipate movements in earnings. Investment analysts increasingly hold that careful analysis of an industry underlying a security is of prime importance in estimating the trends of earnings in the immediate future.

The second speaker was Dr. Sidney Wilcox, Chief Statistician of the

U. S. Bureau of Labor Statistics, who described the Federal Works Project for the study of consumer purchases, jointly conducted by the Bureau of Labor Statistics of the U. S. Department of Labor, the Bureau of Home Economics of the U. S. Department of Agriculture, and the National Resources Committee.

The Chapter met on June 11, 1937, to hear Dr. Halbert L. Dunn, Chief Statistician for Vital Statistics of the Bureau of the Census, discuss "Recent Trends in Vital Statistics." After a short discussion of the history of vital statistics in the United States, and the development of the birth and death registration areas by the adoption of the Model Law, Dr. Dunn gave a panoramic picture of the field of vital statistics. In general, he described a threefold interest and need for vital statistics. Most important is the need of the individual citizen for legal proof of nationality, date of birth, date of death, and parentage, all of which are contained on the birth and death certificate. With the increasing emphasis placed on social security, it is rapidly becoming imperative for every citizen to have a birth certificate. The uses of the Health Department for both birth and death certificates are more generally appreciated. The birth certificate is the start of the maternal and child welfare program, and the death certificate is essential in the control of contagious diseases, and the study of the effectiveness of the general health program.

The accuracy of reported causes of death was discussed in some detail. Statistical tabulations on residence allocation of birth and death are of particular value to the administration of the health departments. Supplemental studies extending from the birth and death certificate will be developed and are of value to health departments.

In addition to the legal use of the certificate for the citizen and the health department needs, there are a variety of statistical interests and sociological values in vital statistics. These are largely involved with statistical tabulations leading to life tables, study of fertility, the falling birth rate, illegitimacy, population estimates, occupational causes of death, internal migration, and social security needs. The outstanding problems facing the extension of vital statistics are not statistical but field difficulties in gathering the material. There is still a considerable amount of work to be done in getting completeness of registration of births in rural areas and obtaining a greater accuracy of the material on the birth and death certificate.

The possibility of linking the solution of these problems with existing agencies, such as, developing county health units, county educational systems, county welfare work, and various types of social activities in the county, was considered by the speaker.

THE WASHINGTON STATISTICAL SOCIETY.—The annual business meeting for the election of officers of the Chapter for the coming year was held on June 10, 1937. O. E. Kiessling of the U. S. Bureau of Mines, who during the year 1936–37 has served as a member of the Executive Committee, was elected to the office of President. Ewan Clague of the Social Security Board, the outgoing President of the Chapter, was elected Vice-President for the coming year. The membership of the Executive Committee will be announced at the first meeting of the fall.

Under the presidency of Mr. Clague, seven meetings of the Chapter have been held, the first four of which have been reported in earlier issues of the JOURNAL. On April 28th, a meeting was held at George Washington University to consider the use of sampling methods in measuring unemployment. Frederick F. Stephan, Secretary of the American Statistical Association, presided. Since this meeting was a continuation of discussion of the same general subject at two previous meetings, no formal papers were presented. Among those taking an active part in the discussion were Aryness Joy of the Central Statistical Board, Edna Lonigan of the U. S. Treasury Department, Loring Wood of the Bureau of Labor Statistics, and Robert Nathan of the Bureau of Foreign and Domestic Commerce. Considerable interest in this general topic has been evidenced, each of the three meetings having been attended by more than 200 persons.

A group meeting of the Chapter was held at George Washington University on May 5th to discuss a simplified method of solving normal equations developed by H. B. Richardson of the Cotton Marketing Service of the Department of Agriculture. This meeting, attended by about 30 members, was called at the suggestion of E. K. Karrer, of the Cotton Marketing Service, who led the discussion.

On June 10 the Washington Statistical Society Chapter of the American Statistical Association held a meeting under the auspices of the Works Progress Administration. The subject of discussion was "The Research Program of the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques." The meeting was arranged by the Works Progress Administration to acquaint members of the technical and research staffs of the Federal agencies cooperating in the National Research Project with the Project's research program. Because of widespread interest in the subject, it was decided to hold the meeting jointly with the Washington Statistical Society. Approximately 500 persons attended the meeting, which was held in the auditorium of the Department of Commerce.

A paper on "The Research Program of the National Research Project," prepared by Mr. Irving Kaplan, Associate Director of the Project, was distributed to all members of the Society in advance of the meeting. Mr. Kaplan's statement outlined the scope of the Project's work and described the approach and perspective which has guided the undertaking.

The presiding officer, Mr. Corrington Gill, Assistant Administrator of the Works Progress Administration, introduced Mr. Harry L. Hopkins, Administrator of the Works Program. Mr. Hopkins in a few words sketched the background of the considerations which resulted in the establishment of the Project.

In introducing the speakers Mr. David Weintraub, Director of the Project, pointed out that the Project's approach went beyond the study of isolated processes and the oversimplified formulation of the problem as being merely one of man versus machines, to a program aimed at determining when and how technological changes take place and how these changes affect the trends in production and employment, and the incidence of unemployment. "This approach compels the study of technological change in terms of social savings gained from technological advance, the distribution of these savings between capital and labor, and the effect of the changing character of this distribution on the nation's income, production, and employment. Within this general approach we also consider the impact of technology on specific industrial situations involving particular industries, occupations, and individuals."

Mr. Weintraub also acknowledged the cooperation of a number of governmental and private agencies which had previously done work within the field or which had collected data valuable for the Project's analyses. These include the Department of Agriculture, the Bureau of Mines of the Department of the Interior, the Bureau of Labor Statistics of the Department of Labor, the Railroad Retirement Board, the Social Security Board, the Bureau of Internal Revenue of the Department of Treasury, the Department of Commerce, the Federal Trade Commission, the Tariff Commission, the Industrial Research Department of the University of Pennsylvania, the National Bureau of Economic Research, the Employment Stabilization Research Institute of the University of Minnesota, and the Agricultural Economics Departments in the Agricultural Experiment Stations of California, Iowa, Illinois, and New York.

Dr. Harry Jerome, director of a number of surveys in the manufacturing industries—brick and clay products, cement, flour, lumber and beet sugar—spoke on "The Place of Individual Plant Histories in Surveys of Changing Productivity." These surveys were conducted in cooperation with the National Bureau of Economic Research. The approach in these surveys is to follow up the determination of the rate of change in labor productivity with an analysis of the immediate conditions of change in the individual plants affected, and an analysis of the general characteristics of the industry and the period in which the changes took place. Furthermore the studies include a consideration of changes in labor requirements in the production of raw materials, machinery and equipment, and fuel and power consumed, as well as changes in the manufacturing process proper. Drawing illustrations from plant records in the various industries, Dr. Jerome described some of the problems encountered in reducing different products to a common unit of output and in determining plant capacity. Per cent of capacity utilized has been found to have a marked influence on the man-hour ratio. Dr. Jerome also described briefly some of the analyses which are being made of plants grouped by relative efficiency, by age, by size, by geographical location, etc.

Dr. John A. Hopkins, who is conducting the Project's studies in agriculture, spoke on the subject of "Changing Labor Requirements in Agriculture, as Illustrated by Data on the Corn Crop." Dr. Hopkins used preliminary results of a field survey and other studies of the corn crop to illustrate the problem of analyzing the causes of the decline in the proportion of our population required to supply agricultural raw materials, and the form which this decline has taken in affecting individual farm enterprises. The problem involves the determination of the over-all volume of output and total labor input in agriculture and, second, by examination of production methods in selected key products, the determination of the relative importance of the principal changes in agricultural technology, of shifts in specialization from area to area, and of organization of the typical farm unit. The important influences affecting labor requirements, either per acre or per unit of product, include the number and sequence of operations performed, the amount of power and type of equipment used, the area in which the crop is grown, the variety of seed used, and methods of disease or pest control. Considerable use has been made of data collected by the United States Department of Agriculture and the agricultural experiment stations, but these previous studies are not entirely adequate because of differences in method or in area surveyed and because few cover the entire period, 1909–36, with which the Project is concerned. A field survey in 58 counties during the past summer was designed to fill in gaps in available data. Emphasizing differences between areas due to varying methods of working the crop and to other factors, Dr. Hopkins pointed out that preliminary results showed an average decline of 20 per cent in hours per acre in corn production since 1909, with the area of least change (Eastern Cotton) showing only 8 per cent and the area of greatest change (Western Dairy) 28 per cent. The use of more power and of larger and better adapted equipment is an important factor in this change. In closing, Dr. Hopkins suggested that the decline in total labor required per farm will not be as marked as it is for the corn crop alone, because reduction of labor per head of livestock has been much less rapid, and the labor used on general overhead work—such as repairing fences and cutting weeds along roadsides—has probably not changed greatly.

Dr. O. E. Kiessling, Chief of the Mineral Production and Economics Division of the Bureau of Mines, spoke on "Technical Progress and Productivity in Mining." The Bureau of Mines is cooperating with the National Research Project on a series of mineral technology and output per man studies. Dr. Kiessling described the work which he is supervising in the extractive industries, as, first, developing reliable and relatively long-term series on employment and output per worker and, second, tracing the accompanying technical advances. The talk was illustrated with material from the various industries covered by the studies—bituminous coal, anthracite, petroleum and natural gas, phosphate rock, crushed stone and other nonmetals, iron ore, copper, lead, zinc, silver, and gold. Dr. Kiessling pointed out that increased utilization of mechanical energy overcomes other factors—such as increased physical handicaps in mining, reductions in grades of ore, and the shorter work-day and work-week—and accounts for the sharp upward movement of ouptut per worker in mining. Other points covered included the following: the varying experience of different regions mining the same product; the increased employment which accompanied increased output per man in petroleum to 1929, as contrasted with most extractive industries which showed declining employment before that year; the adoption of mechanical drilling, loading, hauling and hoisting devices and improved milling in various types of mining; the effects of increased physical difficulties of operation and decreased mineral content of ores in counteracting improved methods; the rise of open-pit mining; shifts of production to new areas of lower-cost operation; and known reserves and the possibility of increasing these by scientific prospecting. Dr. Kiessling concluded with a statement that, in general, output per man in the major mining industries could be expected to increase in the short-run future, though not as rapidly as during the 1920's; that the effect of this on total employment will vary according to total demand for the respective products, with only petroleum likely to increase its man-power requirement over previous levels; that mechanization is changing the kind of workers needed underground, favoring younger men educated to work with machines, and increasing the need for technical men and supervisors; and that the long-run outlook, though the date at which the situation will present itself is not predictable, is clearly one of increasing physical difficulties and increasing costs.

In introducing Dr. M. L. Jacobson, Statistician of the study conducted jointly by the Project and the Railroad Retirement Board, Mr. Weintraub pointed out that the study of the railroad industry included not only the analysis of secondary materials related to employment and productivity, the subject of Dr. Jacobson's paper, but also the analysis of several hundred thousand railroad work histories collected by the Federal Coordinator of Transportation in 1934 and the supplementation of these by a field survey designed to add, for a sample of those workers, employment records during periods of separation from the railroad service and employment and unemployment experience since 1934.

Dr. Jacobson talked on "Employment and Productivity in the Railroad Industry." Since 1921 the value of investment in road and equipment of Class I roads increased from 19.6 to 24.2 billion dollars. The new investment was applied almost entirely to the reduction of costs and improvement of service rather than to new mileage. During the same time employment on railroads was cut nearly in half. The ratio of investment to employment increased about 22 per cent from 1921 to 1929, due primarily to the increase in investment, and increased another 84 per cent after 1929, due almost entirely to the decline of employment. Overhead costs, of course, cannot readily be varied to suit temporary conditions. Thus increased investments, if unaccompanied by increased business, themselves become a force tending to induce further economies in labor costs. The ratio of traffic units to man-hours shows an almost uninterrupted upward trend since 1900 with a further sharp upward turn since 1932. From 1922 to 1935 productivity of train and engine workers in the freight service rose 82 per cent in terms of gross-ton miles and 68 per cent in terms of revenue ton-miles; these increases reflect largely a 40 per cent reduction in man-hours and a 25 per cent increase in the ratio of deadweight to revenue tons hauled. In general, productivity in the freight service has increased much more than in the passenger service. This is due chiefly to the fact that facilities, employment, and hours are much more readily adaptable to traffic needs in freight than in passenger service. Salient developments in the passenger service include the almost continuous decline in passenger miles since 1920, accompanied by a slight increase in passenger-car miles up to 1929, the large decline in both series during the depression, and the slow recovery of both in the past few years. Productivity of road passenger workers has increased continuously in terms of train miles and car miles, but has declined in terms of passenger miles. Important technological changes affecting productivity of train workers include the increases in average tractive power of locomotives, number of cars per train, and speed between terminals. In summing up, Dr. Jacobson pointed out that, especially since railway traffic began to decline, unemployment engendered by managerial and technical changes has become acute. Technical reconstruction of the industry, which would raise the productivity of workers employed, is far from complete. Nor does it seem likely that industrial recovery of the near future will be sufficient to reemploy in railroad work the great number of men who lost their jobs during the depression.

Mr. Tom Tippett, Associate Sociologist on the Project, described some aspects of the labor market in one of the industrial situations selected by the Project for special study. Mr. Tom Tippett's paper was entitled "The Coal Loading Machine and its Effect on Employment in One West Virginia Coal Field." Scotts Run, a coal field in northern West Virginia, afforded an unusual opportunity for analysis of the effects of technological change on employment. This field was opened up as a producing center during the War, and, in common with other Southern fields, enjoyed a relative prosperity—at least as compared with Northern fields—until about 1927, when production began to decline. After 1929 the decline in production and employment was severe. In 1933 and 1934, with beginnings of a reviving demand for coal, mines reopened, and employment began to climb. In 1935, and especially in 1936, production increased. In 1936 the coal loading machine was extensively introduced in the field, upsetting the promise of a reestablished employment equilibrium. All of the people living in Scotts Run depend directly upon the mines for a livelihood. During 1936, while the loading machine was being installed in one mine after another, almost half of the miners were unemployed. Production per man increased, and younger men, sometimes from outside Scotts Run, were hired to handle the machines.

The final speaker of the evening was Dr. Gladys Palmer, who is in charge of studies which the Project is conducting in cooperation with the Industrial Research Department of the University of Pennsylvania. Dr. Palmer's subject was "Recent Trends in the Philadelphia Labor Market." Philadelphia, in contrast to Scott's Run, is a highly diversified commercial and manufacturing city. The series of studies in this labor market have included an employment and unemployment census each year since 1929, and against this background, an analysis of trends in job opportunities, the types of sons who have been, and who have not been, securing jobs, and the occupational mobility of selected groups of workers. Manufacturing employment in Philadelphia is back to the 1929 level (which was much lower than obtained in 1923), but the decline in the unemployment curve has not been as rapid as the rise in business recovery. A partial explanation of this lies in the significant decrease, in the years from 1934 to 1936, in part-time work. Thus the relief load has remained high because it is not so directly affected when a part-time worker obtains full-time employment as it is when an unemployed worker obtains a job. In addition, the population of Philadelphia is older and its families have more employable members than is the case, say, in Detroit; consequently when one member of the family obtains a job it is not always sufficient to enable the family to go off relief. It should also be said that the Philadelphia direct relief load now takes care of a large number of unemployables who eventually will be provided for by other forms of public assistance. Dr. Palmer concluded with a description of some of the objectives of the study of work histories, which will emphasize questions of mobility reflected in occupation, industry and employer shifts, and the relation of age and skill to occupational mobility and to employment and unemployment experience. The groups selected for such study represent various situations of increasing or declining job opportunities in Philadelphia.

NEW MEMBERS

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Vom Saal, Rudolf E., Agent, Travelers Insurance Company, 100 East 42nd Street, New York City

Walker, Dr. Mabel L., Executive Secretary, Tax Policy League, 309 East 34th Street, New York City

Woodbury, Perry S., Statistician, Vick Chemical Company, 122 East 42nd Street, New York City

NOMINATING COMMITTEE

In accordance with the provisions of the Constitution, President W. Randolph Burgess has appointed a Nominating Committee to make nominations for officers to be elected at the next Annual Meeting. The members of the Committee are Edwin B. Wilson, Chairman, Winfield W. Riefler, and Willard L. Thorp.

FREDERICK F. STEPHAN, *Secretary*

REVIEWS

The Design of Experiments, by R. A. Fisher. Second edition, Edinburgh and London: Oliver and Boyd. 1937. xi, 260 pp. 12*s*. 6*d*.

This important monograph on scientific method now greets the eye with a jacket portraying in color a Latin square. Its interior differs little from the first edition except in the addition of an enumeration of 8×8 and 9×9 Graeco-Latin squares, a discussion of procedure when an observation is accidentally lost, and Tippett's treatment of the problem of a cotton mill in which one of the five spindles was found to be winding defective weft. In the last case, the cause of the defect was unknown, but its origin could be traced further by interchanging four component parts of the spindles. These parts were reassembled in 25 ways such that each of the five parts of any one type was used once and only once in combination with each of the five parts of each other type. The reconstructed spindles were tested, five at a time, over five periods, so that each component was used equally during each period. It is shown how from the results the defective part was detected.

The volume is far too closely packed with ideas to be summarized. A few of the most striking portions may be mentioned. The discussion of the nature of inductive inference in the first chapter is supplemented in the next by the case of the lady who thought she could tell by tasting the tea whether the milk was put in first or last. The ramifications of the simple problem of finding out whether she was suffering from an illusion provide an appropriate epitome of the problems of experimentation in general. The meaning of tests of significance and of null hypotheses, and the necessity of randomization, are here clearly explained. A historic experiment of Darwin's is described in the next chapter, where Galton's faulty statistical treatment of the results is corrected. This example serves also as a defense for the assumption of an underlying normal distribution through a calculation showing the trivial difference arising from an abandonment of this assumption.

Agricultural experiments on crop yields, which provide the starting point and illustrations for much of the author's discussion, are introduced in Chapter IV and elaborated in the next chapter in connection with the Latin square. The fundamental problems here are to obtain a valid and reliable estimate of the errors, chiefly due to soil heterogeneity, and to minimize these errors. The Latin square is an arrangement of the treatments of the plots in such a way that no treatment occurs twice in the same row or the same column. One of the many possible Latin squares is chosen with the help of gambling apparatus, which is always necessary in Fisher's schemes in order to assure validity. The systematic squares sometimes used, in order to diminish the errors by distributing the repetitions of each treatment more widely over the field than by chance, are shown to be really inferior to chance arrangements because of the impossibility of obtaining accurate and unbiased standard errors. This brings out a most interesting point. Repetition of an experiment, which is often thought of chiefly as a means of diminishing the errors by averaging, has actually a more essential function in the determination of the variance of the errors through the contrasts among the results of the repetitions. There is no use in diminishing the errors of an experiment by methods which preclude their measurement. Graeco-Latin squares provide a means of testing several questions simultaneously; for example, on the same land and simultaneously, it is possible without loss of accuracy as compared with separate experiments and with various incidental gains besides economy, to test not only the effects of varying fertilizer on the yield of beets but also the effects of methods of cultivation, of varieties of beets, and perhaps of other causes. To the wide possibilities of utilizing a single experiment with a limited budget to test simultaneously an increased number of questions, Chapter VI, on "the factorial design in experiment," is devoted. An ingenious variation of this idea, termed "confounding," is introduced in the next two chapters. Some exercises for the reader have been inserted here. It should perhaps be emphasized further that although factorial designs do not involve loss of accuracy in the mean values measured, as compared with simple experiments when accuracy is expressed in terms of theoretical variance, they nevertheless leave fewer degrees of freedom available for the estimation of error and thus reduce the effective accuracy of the experiment with respect to any one controllable variable. Where the number of degrees of freedom for error is ample, as it frequently is, this objection has of course little force; but for some situations it may become important.

Chapter IX deals with the increase of precision by concomitant measurements. If pigs are fed on various rations, the initial weight of each pig needs to be considered along with the final weight in judging the effectiveness of the ration. The correction to the final weight might be by mere subtraction of the initial weight, or by division by it, or by subtraction of some multiple of the initial weight. The most appropriate multiplier appears in general to be that determined by least squares. A new section in this chapter shows how to proceed when an originally balanced experiment is disturbed by the accidental loss of an experimental animal, plot, or other unit, or of two or more such units.

The underlying principle on which this correction depends may be expressed in the language of least squares, as follows. After carrying through a least-squares solution, suppose that we insert a new observation equation that is satisfied exactly by the values already determined for the unknowns. Then the new normal equations, though not identical with the old, will have the same solutions. The sum of squares of residuals will be the same as before and will have the same number of degrees of freedom as before, i.e., one less degree of freedom than if the new observation had been determined independently of the others. To apply this to a yield experiment on plots arranged in rows and columns, we observe that the unknowns in the corresponding least-square problem are the mean yields for the various rows and columns; and that filling in the yield for a missing plot in the manner prescribed minimizes the sum of squares of residuals.

Chapter X deals with the generalization of null hypotheses and fiducial probability. The concept of upper and lower fiducial limits for an unknown quantity is here elaborated. The eleventh and final chapter treats of the problems of estimation in those more complicated cases in which the estimates to be used are not linear functions of the observations and of the accuracy and amount of information involved. Examples deal with dilution problems in counting microorganisms, determination of toxicity of a drug by the mortality of experimental animals to which it is administered, and linkage of genes.

The economic statistician may at first doubt that this book contains anything for him, since economic problems receive only a brief mention. A closer reading will upon reflection reveal many subtle sidelights on the problems of economic and social statistics. One effect, for example, should be to deflate the idea that by maintaining 48 different state governments we are conducting an experiment likely to give valuable information regarding the relative values of their divergent laws. To make such an experiment strictly valid we should have to distribute the laws to the various states by drawing shuffled cards or some other process independent of their respective needs and desires. Its accuracy could be improved by arranging them in eight geographical blocks of six states each, assigning the laws at random within each block, if the number of different alternative statutes to be compared is six. The randomization could be further restricted with gains in accuracy, by cross-classification according to relevant variables, following the principles of the Graeco-Latin square. Further accuracy could be obtained by treating various historical features as concomitant measurements and making allowance for them by least squares in judging the results. If all this seems grotesque, it will serve to illustrate the nature of the qualitative difference between mere statistical observations and the self-contained experiment which Professor Fisher sets up as the ideal. Yet it will never be possible to dispense with knowledge obtained from mere observation without control or randomization of fundamental conditions. Indeed, the social sciences are in no hopeless condition because of the rarity with which self-contained experiments can be carried out. They have excellent company in this respect in astronomy and meteorology, which are respectable sciences in spite of the impossibility of direct experimentation in their domains.

HAROLD HOTELLING

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A First Course in Statistical Method, by G. Irving Gavett. New York: McGraw-Hill Book Company, Inc. Second Edition. 1937. ix, 400 pp. $3.50.

The author of this text is a mathematician, and his book is the outgrowth of twenty years' experience teaching a foundation course in statistics to students in the natural and social sciences, his course to be followed by more specialized ones in the various departments. The book was first published in

1925 and now appears in a second edition differing little from the original except for the addition of a chapter on multiple and partial correlation and, as the author says, the simplification of methods of deriving some of the formulas. Inasmuch, however, as the present reviewer has not previously reviewed the book, it will be considered as a whole in what follows and not merely in terms of second edition changes.

The author being a mathematician, his book is written as a mathematician would do it, and it is possible that its adoption as a text will be restricted mainly to places where the beginning course is taught by persons who are primarily mathematicians. For it is a fact, whether desirable or otherwise, that many of the existing texts on elementary statistics have been written just to avoid the thing which the mathematician always does—and is equipped to do so well. That is, the mathematician expresses himself in his symbolic language, he starts in general with a definition or an axiom and from this derives his results—formulas or whatever they be. All of which remarks are intended to call attention to and to comment upon a wide difference in purpose, in the extreme cases at least, between textbooks now available for beginning students in statistics: Those by the mathematicians with their emphasis on definition, on derivation, on symbolic notation and the like; and those which have deliberately attempted to avoid the rigors of the mathematician and yet to make his tools available to the uninitiated. The last quarter century has seen an enormous growth of interest in courses in statistics. Where twenty-five years ago such courses were hard to find, today they are numbered literally by the hundreds, and small indeed is the college or university which doesn't have at least three or four courses in statistics in different social science or other departments. This development of academic interest has of course paralleled a growth in the use of statistical methods in business, in public administration, and in research in the broad field of education. But like any new tool which has been suddenly and widely adopted, this one has been subjected to great abuse. The statistical machine has ground out tabulations, graphs, averages, correlations, and the like in great quantities, and the results have been duly added to our "store" of knowledge. One may suspect that the business man has been somewhat canny of this output in his own field, for he pays rather quickly and dearly for his mistakes; but there is no such avenging angel to check up at once upon academic output. When the degree has been awarded, or the article published or the promotion obtained, the researcher can well allow his "contribution" to be filed on dusty book shelves until another "researcher" is faced with the necessity of further extending the boundaries of human knowledge, whether through the pressures of the promotion system or from a pure love of truth for its own sake. All of which is a lengthy but necessary way of saying that there was something fundamentally wrong with the non-mathematical approach to the study of statistical methods; that the tools without the rigor and without an essential understanding of the conditions and limitations of their valid application were dangerous implements in the hands that wielded them.

One may gather from the above remarks that the present reviewer is sympathetic with textbooks in statistics written by mathematicians, and it may be said at once that the text under review is a very good one. Such comments as are made below mainly involve minor items or matters of emphasis. The subject matter that is presented in the book is probably more extensive than can be covered in most beginning courses in statistics, and it has involved very brief treatment of many topics that deserve longer consideration. The classroom teacher can, of course, limit himself to part of the book and can supplement the treatment therein contained—if his own knowledge of the subject goes beyond the book. One essentially good feature of the book is that what it does contain is good statistics. The reviewer, reading from cover to cover and prepared to note things that are definitely wrong, finishes his task with nothing recorded on such a list. What the book contains is good, it is written in a clear readable style, and it is generally systematically arranged.

One question of systematic presentation arises with respect to graphics. The main discussion is in Chapter Three, but Chapter Eleven, near the end of the book, is devoted to logarithmic graphic representation. Would it not have been better to combine the two chapters and to treat the whole subject matter of graphics at one time?

The author introduces one slight change of usage, in connection with graphs of frequency distributions, which seems unfortunate. He uses the term "histogram" to apply generally to all graphs of frequency distributions, referring to the separate graphs as rectangular histograms, frequency polygons, and frequency curves. The reviewer believes it is correct that Pearson applied the term *histogram* only to the rectangular type of graph (see Yule: Introduction, p. 84). This is a minor matter, but it raises the question of the desirability of standardizing notation and terminology over the whole field—the task that has been so well done in actuarial science and which serious students (beginners) so frequently wish could be done for statistics.

The author claims in his preface to have given the "only absolutely correct definitions of median, quartiles, and other division points in print, that provide a logical derivation of a simple formula for determining them." This claim is too sweeping. In the first place, his definition, as he himself admits, involves the hypothesis of uniform distribution of items over the class interval that includes the median, and this hypothesis may not be "absolutely correct." The reviewer would prefer to defend the statement that the only absolutely correct definition of the median requires the hypothesis of a frequency function to represent the universe and that the true median is the value of that abscissa the ordinate of which divides the area under the curve into two equal parts. There is no other *absolutely correct* definition. The median of a sample may therefore well be indeterminate within certain limits. In the second place, the author's special solution of this problem is hardly the first to appear in print. It is all there (described though not given in formula form) in Zizek: *Statistical Averages*, p. 209 (Persons' translation), and the same formula as that used by the author is given in Chaddock. The reviewer has used and taught the identical procedure for twenty years.

There are a few places in the text where the author might well have gone further in simplifying calculation procedures. For instance, Yule's method of calculating the average deviation from observations grouped in a frequency distribution can very easily be presented in the form of a formula, and it is a great improvement over calculating deviations from the actual mean; and Kelley's formula for the average deviation from ungrouped observations deserves a place in any text.

The review of this text offers an opportunity for one final comment which the reviewer believes deserves to be made with respect to nearly every (if not every) elementary statistics text on the market. It is that the logical implications of statistical processes are largely absent from the texts and that beginning students therefore never come to appreciate this aspect of statistical methods. The answer that is almost sure to be made to this objection is that beginning students aren't mature enough to deal with such problems in logic and that therefore the most that can be expected is that they will gain proficiency in manipulation procedures. But this answer cannot be accepted. To illustrate, the traditional method of teaching averages says a few words about averages as type values and may even devote a few sentences to homogeneity of data from which the average is calculated, may even say something about random variation; but these worth-while starts are shortly forgotten, and, in choosing between averages in a given concrete situation, attention is almost wholly concentrated on such things as: (1) easy to calculate, (2) easy to understand, (3) effect of large or small values on the average. The present writer goes so far as to say that, in a problem of the scientific use of an average (and what other use justifies writing a text), the questions of understandability and ease of calculation deserve no consideration at all whenever such consideration involves compromise with other *scientific* characteristics of an average. See, for instance, the emphasis placed upon understandability and ease of calculation by Yule (by implication at least) and by Mitchell: U. S. Bureau of Labor Statistics Bulletin No. 284 (by explicit statement and by repeated emphasis). Is there more reason that the public consumers of averages should understand all their technical characteristics than that the public which drives automobiles should be technical engineers? Isn't it more important that the makers of averages should know how to make them properly, how then to interpret them, and should therefore place in the hands of the public only averages that are adapted to the use to which they will be put?

Professor Gavett, in common with other authors of statistics texts, it seems to me, does not put sufficient emphasis on this feature of textbook writing. He devotes, for instance, just one page to the discussion of the advantages and disadvantages of the several averages. I would have used at least half the chapter for this all important task. He subjects himself to misunderstanding by a statement that the median is less affected by accidental variations than the arithmetic mean, a statement that can be found in essentially these terms in almost every elementary statistics text and which has been the cause of untold difficulties in teaching the scientific features of an average. How, for instance, square the above statement with the well-known fact that the sampling variation of the median is in general greater than that of the arithmetic average; and in a normally distributed universe is twenty-five per cent greater.

The reviewer hopes that the author will not take the above remarks as an unqualified condemnation of a text that he thinks has real high quality. The remarks are intended rather to express the hope that the texts (and the revisions) of the future will soon begin to emphasize an aspect of formal statistical methods that to date has been largely neglected and that must be made an integral part of our teaching of statistics if the subject is ever to attain the position as a scientific technique that it deserves.

BRUCE D. MUDGETT

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Statistical Methods in Biology, Medicine and Psychology, by C. B. Davenport and Merle P. Ekas. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Fourth Edition. 1936. xii, 216 pp. $2.75.

The fourth edition of *Statistical Methods* by Davenport and Ekas has been changed materially from the preceding edition. These changes involve in particular new chapters in connection with the descriptive matter, as well as basic changes in the content of the statistical tables. The first three chapters on variation and measurement, seriation and plotting of data, and the classes of frequency polygons, remain essentially unchanged. Appropriate examples, as aids of computation, are introduced throughout the text. The remaining chapters in the new edition are largely new material on the Analysis of Variance, Correlated Variability and Measures of Relationship, Heredity, and Special Topics. Throughout all of these chapters, examples of computation have been introduced in order to permit the student, unfamiliar with statistical technique, to obtain a working knowledge of statistics. Owing to the condensed nature of the book, there is little space for text other than the presentation of equations and the computative examples which accompany each particular statistical technique. Consequently, the book can by no means be considered a textbook for the beginner in statistics.

The selected reference list of periodicals, published tables, and literature, has been shortened and completely revised in the fourth edition. The list consists of references to statistical technique and methodology, rather than a bibliography of source data, which was attempted in the earlier editions.

The tables are, on the whole, more practical in this edition. Table 1 involves an extensive list of statistical formulae. The logarithm table and that of sines, cosines, tangents, and cotangents, which occupy approximately one-third of the previous volume, have been completely omitted. This space saving has been taken up to a certain degree by tables dealing with statistical significance, i.e., chi square, degrees of freedom for mean variance between samples, probable error, $1-r^2$ and the square root of $1-r^2$.

Much could still be done to make these tables more readable by separating the printed tabular material by spaces or lines. The tables as a whole, however, are definitely better set up than in the previous volumes.

The new edition of this book is the same size as the old. Unfortunately, it is bound in stiff-backed leather and consequently cannot be carried in the pocket with quite the ease as the third edition.

HALBERT L. DUNN

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Interpolation and Allied Tables, reprinted from the Nautical Almanac for 1937. London. Published by His Majesty's Stationery Office. Pp. 839–941. 1 shilling. (Obtainable from the British Library of Information, 270 Madison Avenue, New York, 35 cents.)

Due appreciation of these tables would constitute a review as long as the tables themselves. In spite of the increasing popularity of Aitken's processes, interpolation by differences will hold its place in many lines of work, and it is a pleasure to see a real contribution to the art. The Bessel and Everett formulas are considered by Dr. L. J. Comrie to be the best for nearly all purposes, and it is these that are abundantly tabled and illustrated. In some tables, the coefficients themselves proceed uniformly; in others, as is more usual, the phase n proceeds uniformly. Table XX shows the first three Lagrange coefficients with first differences, n proceeding by steps of 0.01. The Bessel, Everett, and Lagrange formulas are written out repeatedly in convenient locations, arranged in several different ways for accommodating different styles of tables and varying requirements of accuracy.

The pamphlet is much more than just another table of coefficients. Full facilities are provided for use of the "throw-back," a device that has been thoroughly tried out at H. M. Nautical Almanac Office and pronounced a great time saver when applicable. It consists of replacing the variable coefficient of fourth differences by a constant multiple of the coefficient of second differences; in Bessel's formula, B^{iv} is replaced by $-0.184\ B''$, whereupon the modified second difference $M''=\Delta''-0.184\Delta^{iv}$ used in place of Δ'' permits the approximate accounting of fourth differences. Table XXII, though the columns are not clearly labeled, is a multiplication table for finding $0.184\ \Delta^{iv}$; and Table XXVI shows the error introduced in units of the fourth differences. This style of throw-back is applicable if the requirements in accuracy are not finer than 0.00046 times the fourth difference, and if fifth and higher differences are being neglected. In other circumstances, other styles of throw-back are possible, as noted on p. 927 and by Milne-Thomson in his *Calculus of Finite Differences*, pp. 71–72.

Another feature is the table of coefficients for computing derivatives from differences, and the formulas for computing differences in subdivided intervals. The explanation of the tables is not difficult to follow—even the details of machine calculation. A new procedure is illustrated for inverse interpolation by differences, the method having been in use in H. M. Nautical Almanac Office since 1934. H. M. Stationery Office is to be commended for reprinting these tables and making them available at a low price. The pamphlet comes with heavy paper cover, saddle stitched.

W. EDWARDS DEMING

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U. S. Department of Agriculture

Note added in proof. In a recent letter Mr. D. H. Sadler, now superintendent of His Majesty's Nautical Almanac Office, has informed me that in the expression for M^{iv} on page 929 the coefficient appearing as −0.28727 should be −0.27827. Some copies have been corrected, but not all.

W. E. D.

Gesundheitsstatistisches Auskunftsbuch für das deutsche Reich, by Kurt Pohlen. Berlin, Germany: Verlagsbuchhandlung von Richard Schoetz. Veröffentlichungen aus dem Gebiete der Medizinalverwaltung. 1936. xvi, 333 pp.

The unstable situation in Europe since the World War has caused European nations—Germany, Italy, and Russia in particular—to stress the importance to the national economy of a healthy and productive population. A natural outgrowth of this emphasis is the demand for more adequate information about the health of the population to serve as a basis for legislative and administrative programs. Dr. Pohlen has compiled an abstract which presents in a single volume a wealth of material on a great many phases of public health in the German Reich.

The abstract consists of a series of tables under eleven general headings, each dealing with a particular aspect of public health in Germany. Part I is a listing of the national and local health districts of the Reich. In order properly to evaluate the data contained in this compilation, it is necessary to recognize that private and public medical activities in Germany are as complex as the system of government. These activities have become more and more integrated and more immediately identified with the policy of the State. Some hint of this trend is given in the foreword by Dr. Reiter, president of the Reich Health Office, who says, "The National-Socialists have again awakened the consciousness in Germany that a rational and valid program for the development of the German people is indicated. The care of the health of the people should be the problem of every administration which, from a biological viewpoint, means developing that which promotes the health and productivity of the population . . . " The social insurance system in Germany has played a large part in the integrating process, and this to some extent makes possible the collection of more detailed statistics than is usually the case in the United States.

Part II is concerned with the provisions for the maintenance of the health of the German people. These provisions fall into five divisions, the first of which deals with medical and nursing facilities. Hospital facilities are tabled in the second division and classified into private, public, and free public hospitals. Data are given for each type of hospital by bed-capacity groups, functional classes, such as tuberculosis hospitals, and by diagnostic groupings. Several of the tables in this part have a misprint in the title. The data given are for 1932, whereas the main title presents them for 1923. The third section of Part II is devoted to the pharmaceutical resources of the Reich, and the fourth section to statistics of the social insurance system. The fourth section is of particular interest in that it shows the very large part which social insurance plays in public health in Germany. There does not appear to be given, however, a figure for the total number of insured, although the number covered by each type of insurance is tabled. One hesitates, though, to total the tabled figures, since this addition might result in some individuals being counted twice. The last subheading under Part II sets forth the results of the activities of the public welfare organizations, such as the Red Cross.

Data on population and on changes in population are contained in Part III. Most of the figures are given through 1933. The population for the area of Germany in that year was approximately 66,000,000. The manner of growth of the population has not been uniform throughout the Empire. This is brought out by a chart showing the population at various times during the period from 1816 to 1933. The population of Germany tends to reflect, more or less clearly, the changes in the political situation. The marriage rate prior to the war remained fairly constant at a level of 8.0 marriages per 1,000 inhabitants per year. During the war, the rate fell to 4.0, but in 1920 it climbed again to 14.5, dropping off thereafter to the prewar level. In 1933, however, the rate reached 9.7, and in 1934, 11.2. This result again is probably an outgrowth of the policy of the State. In 1934 the birth rate was 18.0 per 1,000 inhabitants per year and the death rate, 10.9.

One is reminded by Part IV of Shakespeare's seven ages of man, for, with the exception of the first subheading dealing with the prenatal period, figures are given on the period of birth, infancy, the preschool period, the school period, the "productive" ages, and old age. It is difficult to separate the influence of the Government from the other influences bearing upon these statistics, particularly the data on births and population. In 1933, to cite one instance, the number of illegitimate children born in Germany was slightly more than 10 per cent of the total births. For the United States the data published in *Birth, Stillbirth and Infant Mortality Statistics* for that year yield 4 per cent as the figure for the ratio of illegitimate births to total births. How much of the rate for Germany is due to the Government's attitude toward illegitimacy, it is hard to say. Some of the difference between the rate for the United States and that for Germany may, perhaps, be accounted for by better reporting in Germany. The section dealing with statistics of infancy contains a pie chart showing the nutritional status of infants in Prussia. Only 8.5 per cent of these infants are placed in the good nutrition group, the remaining 91.5 per cent being split about equally into the fair and poor classes. A statement on the method of collection of these data would not have been amiss. What age groups does the term "infant" include? Various anthropometric measurements are presented in the section on the development of the body in childhood and youth, and correlation tables are set up for certain of these measurements. This section should prove of particular interest to the child hygienist as well as the anthropologist. Some industrial morbidity statistics are presented in the section dealing with the "productive" ages. In this subheading, as in the one which follows on old age, the statistics are again linked with the administration of the social insurance system.

Marriage, divorce, and the congenital diseases form the theme of Part V under the general heading of Bases for Population Policy. Statistics on the marriage loans of the State are given in this section.

The infectious diseases are treated in Part VI. The subheadings on venereal diseases and on the activities of the organizations administering the venereal disease problem are of particular interest at the present time when public health authorities and the public in general are focusing their attention more sharply than ever on these diseases.

Cancer and diabetes are dealt with in the next section, which also contains tables on the mental diseases and alcoholism. As in this country, the death rate from cancer has been steadily increasing. In 1931 the rate for Germany was 137 per 100,000 population. It is not mentioned what forms of cancer are included in this rate. The figure for cancer and other tumors given in *Mortality Statistics for the United States* for 1931 was 109.9 per 100,000 population.

Part VIII contains tables showing the number of blind, deaf, and crippled, by age and by cause and type of infirmity.

Accident and suicide statistics are set forth in Part IX. Since the war years, which witnessed exceedingly low suicide rates in Germany, the incidence of suicide has steadily increased, and in 1932 a rate of 41.6 per 100,000 population was recorded. This contrasts with a rate of 17.4 per 100,000 population for the same year in this country. Part IX also contains a subheading on health conditions in the German army during the World War.

General Morbidity and Mortality Statistics is the title of the tenth section, which is subdivided into a section on various morbidity statistics, such as health indices, a section on life table functions, and a final section on the causes of death classified under the headings of the International List.

The cost of the various health services is set down in the last section. It is hardly necessary to stress the value of such information to an administrator. It is to be regretted, however, that some attempt was not made to present the costs on a per capita basis. Such an arrangement would, perhaps, permit comparisons with other data which might not be made otherwise. This statement is particularly true as regards the costs of the various types of social insurance, which on a per capita basis would be of timely interest in this country because of the social security program.

The value of Dr. Pohlen's abstract, over and above the value it has as a source of information on various aspects of public health in Germany, lies in the fact that a bird's eye view is gained of the public health setup. By placing in a single volume data on various phases of public health, the interrelationship of the parts is more clearly brought into focus. Moreover, fruitful lines of inquiry may be perceived which might otherwise have been neglected. Many public health workers, feeling the need for some such compilation for their community as Dr. Pohlen presents for Germany, have kept notebooks for their personal use. The usefulness of the abstract would be enhanced if some statement were made at the beginning of each section on the source and method of collection of the material. Without such statements, there is danger of unwarranted comparisons being drawn and of valid comparisons being overlooked.

Paul M. Densen

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De Bevolking van Amsterdam. Statistische Mededeelingen van het Bureau van Statistiek der Gemeente Amsterdam. Deel IV: Statistische studie over huwelijk, echtescheiding, geboorte, sterfte, vestiging en vertrek. Amsterdam. 1936. J. M. Meulenhoff. 206 pp. F 2.50.

An official publication issued by the statistical bureau of the municipality of Amsterdam, this book is concerned with the records of marriages, divorces, births, deaths, and migration into and out of the city. It is much better than such publications usually are because the editors have not confined themselves simply to presenting data but have taken pains to add extensive comment. As a result, the volume contains valuable information for the student of economics or sociology who is interested in the demography of a large European city.

The vital statistics of Amsterdam are kept with great accuracy. This condition is chiefly due to legal regulations and is equally true of all the European countries which have adopted the provisions of the *Code Napoleon* with regard to the *état civil* (control of registration). As a result of these provisions, all births, marriages, divorces, and deaths have to be recorded in registers kept by the municipal authorities. Even changes of residence have to be reported to the city hall. It is needless to say that, under such a system, vital statistics attain a much greater degree of accuracy than in the United States, for instance, where such strict legislation does not exist.

In the present volume, all the phenomena which are revealed by the vital statistics of the city of Amsterdam are thoroughly discussed by competent specialists. Tables, charts, and diagrams are used profusely to illustrate the text. The figures for Amsterdam are compared with those of other cities at home and abroad and with those for the Netherlands as a whole.

One interesting feature is that different tables are given for the various religious denominations; for instance, the statistics show that the birth rate is the highest among the Roman Catholics and the lowest among the people who do not belong to any denomination. The same classes have, respectively, the lowest and the highest divorce rates. Besides separate figures according to religious creeds, an attempt is made also to give distinct tables for the different social classes.

RAYMOND DE ROOVER

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Prices in Recession and Recovery, A Survey of Recent Changes, by Frederick C. Mills. New York: National Bureau of Economic Research, Inc. Number 31. In cooperation with the Committee on Recent Economic Changes. 1936. xv, 581 pp. 60 tables, 16 charts. $4.00.

As the efforts to stabilize commodity prices multiply in volume and increase in importance, the urgency of understanding the nature of price changes and the structure of the price system becomes greater.

There is no doubt that the problems growing up in this field dominate a very large part of economic research at this time. The latest volume written by Professor Mills adds new and valuable data to the store of knowledge to which he has already contributed rich findings. The survey of price data through a peculiarly interesting period in American economic life cannot be ignored by any serious student in the field and will be of immense value to all those working on this type of problem.

The material contained in the book is many-sided and various. The chapter headings give some indication of the scope of the work, but, to gain a more exact impression, it would be necessary to consider the very suggestive subheadings to know the nature of the analysis. The first major division covers the pre-recession situation, recession and depression, and recovery. The angle of approach shifts then to take up in somewhat more detail the special aspects of the recovery of prices, including the fortunes of primary producers, manufacturing industries, manufactured goods and raw material, capital equipment, consumers' goods, and increasing productivity.

Some of the subdivisions listed in these divisions indicate the existence of those border-line cases, overlapping concepts, and insufficiently defined terms, making it difficult for the writer and the reader to classify commodities in a useful way. This difficulty, which is implicit in all work in the field, cannot at present be eliminated, and it accounts for some of the differences in treatment by different authors.

A long statistical appendix and many exhibits included in the text at various points give relatives and indices of such importance that they would have sufficed to justify the work involved without the interesting commentary and comparisons made by Professor Mills.

As in all controversial fields, there will be considerable query with respect to certain statements, and some differences in opinion on interpretation. There is occasionally an implication of symmetry of price movement and comparability of cycles which might be questioned. On page 14 there is a suggestion of homogeneity in the character of the goods and the types of fluctuations which, though not definitely stated, makes an impression some might challenge. As the statistics seem to show similarity in some cases, there is still room for question whether this similarity is not an accident growing out of the nature of the instruments of quantitative measurement, and not really a characteristic of economic fluctuation. Professor Mills shows that he is aware of the peculiarities of price conditions which often blur their meaning because quality cannot be brought out. Many of the relatives conceal significant differences of type or quantity which cannot be revealed by statistical processes.

Familiar and understandable devices are used to show the diversity of movement of various price relatives. The fan-like spreading apart of the prices of various commodities is used to illustrate the types of stress and strain to which the system is subject. It is clear, however, from this analysis, as from other studies, that it is not possible to judge when prices are moving together to establish a new norm and when they are fanning apart to exert an unhealthy pressure on economic systems. Only a careful survey of particular cases can make possible a diagnosis of the significance and causes related to these phenomena. Such a detailed analysis is not possible within the scope of such a study, nor could it be carried on in connection with all the various price relatives included here. Because of these practical limitations, it may be worth considering whether it is possible to make a different statistical approach to the question in order to avoid possible misinterpretation.

Many of the students who use this material will not have the breadth of knowledge possessed by the author and will not immediately recognize the dangers of assuming that base points have a universal significance. It is conceivable, for instance, that semilog curves presented for certain typical price relatives and extending over several cycles would serve to caution the reader and suggest to him the limited meaning of using any year as a norm. Although it is true that this type of curve is complicated and even confusing to some, it may be necessary to give perspective in certain cases.

Although the interpretation in the text is sound, it is possible that some of those using the material will jump to false conclusions. The complexities of price analyses are already appallingly great, and it is well to observe all the cautions and qualifications in the text which suggest the various types of factors. A careful reader is definitely made aware of the difference in maturity of the industries, in types of markets in which they are sold, and in the nature of professional speculation which bears on short-run price changes. Other complications hinted at here and there, and not always emphasized enough, grow out of the market prices, the influence of jobbing, the mechanisms of commerce, and special contractual relations. These factors lead to a jerky and, at first sight, irrational response of prices to cost and to demand. Powerful influences of this nature may distort price relationships more at certain phases of cyclical fluctuations than at others.

The study of rebates, discounts, commissions, and other special arrangements, though not possible within the framework of this particular study, should be carried on by those who wish to bring together the theoretical and actual business experience in order to gain a complete picture of the situation.

The peculiar situations resulting from special recovery measures in 1932 and 1933 are sketched in the later sections of the book. No clear answer is given in the discussion, nor can it be given on the basis of price data, to the question regarding the effect of recent controls and special efforts on the speed of recovery. The footnote on page 307 gives guarded acquiescence to the idea held in many quarters that the turn toward recovery in 1932 gives a point of reference which marks a new phase in the cycle. The discussion on page 458 of "points of diffusion" is very suggestive and enlightening.

It must be admitted that no short review can do justice either to the value of the material or to the diversity of ideas in the study. It may well be that we have reached a point where emphasis must shift back toward the more classical type of analysis, now that we have available an abundance of data from all types of industry representing practically every variety of commodity and fairly representative of the country as a whole. If more quantitative data are needed, they should perhaps come in such a way as to throw light on regional differences. We must devote further effort to sharpening our concepts and sorting out the more important theories from the mass of ideas which are now available in print and elsewhere. Professor Mills has done a real service in giving us not only a new store of facts but also in putting his ideas and interpretations before us.

ELEANOR LANSING DULLES

Social Security Board

Migration and Economic Opportunity: The Report of the Study of Population Redistribution, by Carter Goodrich, Bushrod W. Allin, C. Warren Thornthwaite, Hermann K. Brunck, Frederick G. Tryon, Daniel B. Creamer, Rupert B. Vance, Marion Hayes, and others. Philadelphia: University of Pennsylvania Press. 1936. xvii, 763 pp. $5.00.

This book is the final report of the study of population redistribution, an investigation undertaken in 1934, under the auspices of the Wharton School of Finance and Commerce of the University of Pennsylvania, with funds supplied by The Rockefeller Foundation through the Social Science Research Council. The study sought to determine what internal movements of the population were necessary and desirable and what part the Government should take in directing them. Special portions of the study have been issued in four *Bulletins*.

The formal divisions of the book are as follows: a Preface; a very short Introduction; Part I, "The Need for Migration," consisting of eight chapters and occupying nearly 500 pages; Part II, "The Control of Migration," made up of four chapters; and four Appendixes, "The Analysis of Past Migration," "Wheat Production in Western Kansas," "The Location of Manufactures," and "Memorandum on the Selection of Manufacturing Areas for the Housing Program." Nine plates, 79 figures, and 79 tables are utilized to present the masses of factual data assembled in the study. The work includes an index, but a very inadequate one. It does not give names of the authors and books referred to, an omission made more serious by the failure to include a bibliography with the study.

The book centers attention upon the problems, "Where should the people be? And how can they get there?" The first chapter is an abortive attempt at indexing and correlating levels of living and migration, an attempt in which an income tax-telephone-radio index was used with all seriousness in an attempt to gauge fluctuations in the national plane of living, and in which the percentage change in population was used as a measure of migration. Then the book develops into a mosaic of excellent treatises by the various specialists. Thorough expositions are given concerning the special problems of the Appalachian Coal Plateaus, the Old Cotton Belt, and the Great Plains. Detailed analyses are presented showing the changing distribution of resources, the changing pattern of industrial location, and the changing demand for manpower. An exception to the general excellence of the study is the very inadequate summary of the record of unguided migration. This, however, is followed by concise and informative summaries of experience in controlling migration in Russia, Germany, and England. A critique of American measures is confined mostly to New Deal experiences but is fairly adequate on that score. The final chapter, "Toward a Migration Policy," indicates the unsatisfactory nature of the information about migration and how inadequate are the data concerning the problem. Further research and particularly the inclusion in the Census of a question dealing with migration are the principal recommendations.

Probably through the efforts of Rupert Vance, the report recognizes that disproportionate shares of the burden and cost of rearing future generations of Americans are falling upon the South and other poor rural areas and that the inadequate resources of these sections are reflected in the quality of the migrants who go to replenish the populations of urban areas. It recommends equalizing the burdens of rearing and educating the children of the nation, although no definite measures for attaining this objective are specified.

The authors are to be congratulated for successfully overcoming many of the difficulties in the way of coordinated research. It is true that the technical training of some of the writers occasionally leads to minute considerations of insignificant details, a procedure which tends to obscure the broader perspective of the study. A better utilization of the entire literature on migration might have been secured had one of the rural economists or sociologists from the Agricultural Experiment Stations participated in the study, for they are the group who have contributed most to the study of rural-urban and farm-to-farm migration in the United States. Nevertheless, the work as a whole stands as the most valuable contribution yet made towards an integrated national policy relating to migration.

T. LYNN SMITH

Louisiana State University

Three Years of the Agricultural Adjustment Administration, by Edwin G. Nourse, Joseph S. Davis, and John D. Black. Washington, D. C.: The Brookings Institution. Publication No. 73. 1937. xiv, 600 pp. $3.50.

This is the seventh and concluding volume in a series of current studies of the agricultural adjustment program undertaken in 1933 under the auspices of The Brookings Institution. The preceding volumes are specific studies of the A.A.A. program with respect to marketing agreements, wheat, the dairy industry, tobacco, livestock, and cotton. This final volume is an attempt to summarize and appraise the program as a whole. It is interesting both as the most comprehensive treatment of that subject thus far available and as an experiment in current interpretation of a large-scale contemporary program. The prominence and recognized ability of all three of the authors make the undertaking especially valuable.

The study must be judged with respect to its success in measuring the effects of the forces brought into play by the A.A.A. program and as a study in economic and social philosophy. Neither task could be so handled as not to afford abundant grounds for disagreement on the part of many readers. In the more definitely economic phases of the analysis, some critics will find the treatment over-simplified and too strictly Marshallian in type. This reviewer feels, however, that it reflects with reasonable accuracy the general nature and magnitudes of the effects, except in a few instances which for lack of space cannot be discussed here. The appraisal in terms of basic philosophy and the conclusions drawn seem less satisfying and not always entirely consistent with the findings of fact earlier discussed.

The make-up of the book is as follows: first, a brief historical sketch concerning agricultural adjustment as national policy. This is followed by chapters dealing with the adjustment act, administrative setup, programs, production control, commodity loans, purchase and diversion, marketing agreements, administrative problems, effects on various groups, and contributions to recovery. There follow a section on A.A.A. philosophy reconsidered and supplementary discussions by J. S. Davis and J. D. Black bringing out certain divergencies in points of view. Appendix A, by H. B. Rowe, provides much of the qualitative analysis on which the conclusions as to fact were based.

Certain general conclusions concerning the book seem to this reviewer to be warranted. First, the factual presentation, though inevitably open to challenge at many points, is by far the best available to date. Second, the book seems less satisfying than the best writing these authors have done elsewhere. Third, the discussion of philosophy and basic objectives lacks the depth and scale which might have been expected of these writers. One wonders whether there may have been too many other demands on their time and a too close-up view to permit an appraisal that will stand the test of time. Possibly also there would have been advantages in separating into two different studies the analysis of the mechanics of the program and the study of basic policy considerations.

Space permits only brief mention of major conclusions. Some of the most important of these have to do with the effectiveness of the program. In general, the authors feel that other factors in the situation had much more to do with the reductions in output than did the A.A.A. reduction programs, except in cotton and tobacco. The authors agree, however, that in another set of circumstances the control devices would probably have had more influence, though they also doubt that such influence could have been maintained for an indefinite time. For example, they say, "all in all, we consider it quite improbable that the A.A.A. could have achieved without resort to coercive measures a net reduction of the wheat crop averaging over 160 million bushels a year, if as much. Such a reduction would have left production averaging at least 700 million bushels a year, or well in excess of ordinary domestic requirements, thus making reduction of excess carryovers dependent on a dubious development of export outlets or extraordinary diversion operations." Likewise in the matter of corn reduction, they state, "had normal weather conditions prevailed in both 1934 and 1935, the A.A.A. with the same programs or ones calling for more drastic curtailment, would have had a much greater influence on production. Conceivably the outturn might have been held down to 80 or 85 per cent of what it would otherwise have been, and a net reduction of 300 to 400 million bushels obtained each year. Under these circumstances, however, production in the two years would have been much larger than it was."

"Our general conclusion from the experience with production control in 1933 to 1935, so far as we can observe it through the dust of the drought, is that the effectiveness of these devices is such as to make them practical in emergency periods. . . . The experience does not, however, give support to the belief that similar control could be made practicable as a means of holding the course of production over the years close to a line laid out in accordance with a continuously operating economic plan." (J. D. Black dissents from this view as regards long-run effectiveness.)

The purchase and diversion activities have been more extensive and on the whole more successful than most people have realized. They have, however, been carried on too largely from the standpoint of raising agricultural prices, rather than of most effective handling of the commodities in the national interest.

The attitude toward commodity loans of the type used by the A.A.A. is one of skepticism, although the authors feel these may have a place in certain emergency situations.

The marketing agreement type of control is regarded as by no means perfected but of sufficient promise to warrant continuance for certain specialized producing territories, if improved and more adequately safeguarded from abuse. For milk marketing, however, this seems not to be an adequate mechanism.

Appraisal of the financial effect on farmers indicates gains of 1.8 to 2 billion dollars for the period, offset by some 10 to 25 per cent, which represents increased costs to farmers as consumers. The total cost of the program to the Federal Treasury was put at around 900 million dollars exclusive of the 900 million dollars collected in processing taxes. The estimated cost to the Treasury includes 100 million dollars loss to it through the ½ cent per pound reduction in import duty on sugar.

The authors conclude that "the recovery argument was sound in the sense that the effect of agricultural adjustment programs has been on the whole on the positive rather than the negative side.... The experience discredited those who believed that agricultural relief could bring about complete general recovery." In discussing the relationship of the program to planning activities, the authors feel that "the program seems on the whole to take on more definitely the character of financial aid for everybody and less that of specific implementation for a planned system of efficient farming.... If real planning is to be forwarded, these barriers (intrenched special interests) will have to be broken down, and it will have to be demonstrated that the A.A.A. can take steps which give better organization, higher efficiency, and lower cost to the nation's agriculture as a whole, even in circumstances which are to the clear disadvantage of whole states or even sections, at least in the immediate situation."

This reviewer does not agree with some that the divergent views expressed particularly by Black and Davis have vitiated the book. They have rather pointed the way to further explorations needed especially as regards the bases from which the different authors reason. Black apparently stands nearer to Wallace and Tolley in thinking of a rather aggressive, continuous planning program oriented pretty much to farmers' wishes. Davis seems to look upon the procedures more largely as methods of meeting emergencies, "the fire department" or "War Department" setup. Nourse's views in these connections do not appear very definitely.

A serious lack in the present volume lies in the fact that the matter has been discussed almost wholly as an agricultural problem rather than as a national problem. This is one of the surprising features of the book, in view of the acknowledged stature of its authors. Some of the most stimulating concepts presented with respect to a national outlook are to be found in the supplemental statements by Davis and Black; for example, Davis' comment on page 481, that the Department of Agriculture should devise and mature provisional programs somewhat as the War Department does, is one that deserves fuller development, although possibly not in this particular book. Black's supplement also opens up some very fruitful lines of thought, though, in the opinion of this reviewer, the first part of that section is inadequate. Most of his later points are well taken and thought-provoking.

Several aspects of the program seem to be dealt with in a less penetrating way than might have been expected. This statement is particularly true of such sections as the one pertaining to large payments to given growers and the one pertaining to the effects on the poorer classes of laborers and tenants. The first of these is dealt with even less frankly than in the Senate's request and report dealing with this subject. The real challenge in this situation was not whether anyone had been reprehensible in claiming or giving large payments but whether the basic plan itself was so designed as to make suitable classifications among recipients of benefits. To class payments as not large if under $10,000 is, to say the least, accepting rather undiscriminatingly the less-than-frank official treatment of this matter.

One is surprised at occasional statements which seem either unduly defensive or inadequately investigated; for example, "in general, however, outside the South no major criticism of the landlord-tenant phase of the A.A.A. program arose." The authors comment, "the A.A.A. was never conceived for the purpose of equalizing income or restoring freedom of initiative and equality of opportunity among different tenure classes within the farm population." Possibly this is true, but, if so, it would surely seem that the adequacy of its conception might well have been discussed more fully by these writers than was done.

One of the least satisfactorily handled sections is that on the Consumers' Counsel. There is no recognition of what has seemed to this reviewer the wholly unsuitable location both of the Consumers' Counsel in the A.A.A. and of the Consumers' Advisory Board in the N.R.A. In fact, the authors go out of their way to commend this provision in the program. They state, "it must be said of the A.A.A. that it has made the beginning of an approach to the problem of agriculture from the standpoint of the consumers, and that it has kept the consumer more nearly in the picture than other agencies identified in name with a group or industry." It is difficult to justify such a statement when we consider the long records of agencies like the Interstate Commerce Commission, the Food and Drug Administration, and the Federal Trade Commission, by indirection at least designed for the protection of consumers. The conclusion that the Consumers' Counsel function should be to aid the Agricultural Adjustment Administration in analyzing the effects of these programs on the consumer seems well taken. Obviously it could not in its then existing relationship perform the kinds of functions which its early leadership had in mind. This statement does not alter the fact that in both A.A.A. and N.R.A. the consumer position was precisely that of an employee working under the benevolent despotism of a corporation which is willing to provide welfare workers to study his problem but which has no intention of recognizing direct representation of his interests. For example, Black states, page 488, " . . . the continuing program conceived by A.A.A. officials is not one of reducing supplies to the point of raising prices to unreasonable levels for the producers of farm products, but instead one designed to hold production roughly near an equilibrium conceived *by it* (italics ours) as equitable as between agriculture and other classes. . . . " Most students close to the realities of the situation feel that the Agricultural Adjustment Administration has handled these powers with wisdom and moderation. This judgment, however, does not seem to alter the principle that, with its present setup, it is both special pleader and judge in the same case.

Appraisal of any current large-scale movement at such close range inevitably presents many difficulties. This book does not provide a final word on any of the matters dealt with. It does seem to this reviewer, however, to make very worth-while progress toward understanding the effects of the various phases of the A.A.A. program. It merits both study and critical analysis by every serious student of national policy.

M. R. BENEDICT

University of California

Explorations in Economics, Notes and Essays Contributed in Honor of F. W. Taussig. New York and London: McGraw-Hill Book Company, Inc. 1936, xii, 539 pp. $5.00.

This collection of "notes and short essays," by students and associates of Professor Taussig within the fields of economics in which he was particularly interested, was published in his honor on the occasion of his seventy-seventh birthday. The most that need be said in a short review notice is that it is a fitting monument to the occasion. The list of contributors is a sufficient memorial to Professor Taussig; it is certainly more impressive than could be a similar list for any other American, perhaps any other economist of the period covered by Professor Taussig's long active life. These names also speak for the character and value of the book itself. As the anonymous editors do well to remark, several features of Professor Taussig's work escape portrayal in such a volume. They refer to his important public activities and his great contribution to economics as editor of the "Quarterly Journal." The reviewer would underline the latter. It would hardly be an exaggeration to say that there is no worker in the field of economics who is not in a real and important sense a "student and associate" of Professor Taussig's. The present writer may take occasion to say that he got his own start in the serious study of economics from Taussig's "Principles," though not in Taussig's classes, and has always considered it easily first among American treatises and textbooks, considered as a book. On doctrinal positions he has of course found in it much with which to differ, as any economist does in any book, especially one covering so large a field.

The forty-eight contributions contained in the volume are published under three sectional headings dealing, respectively, with the fields of international trade and tariff, general economic theory, and the social setting of economic activity. Each section is introduced by a critical essay on Professor Taussig's thought in the corresponding field. Subsequent essays treat independently of topics of special interest to their authors. The third section has proved of most interest to this reviewer, especially the introductory essay by Professor Talcott Parsons. Perhaps such symposium volumes are likely to find their chief value for brushing up on fields more or less apart from the reader's narrow specialty. The writer has never felt intensely excited about international trade theory, which seems to be rather a matter of pedagogy, and an obvious rather than a really special "case" under general economics. It goes without saying that Professor Viner's introductory essay is judicious and appropriate. This is obviously not the place to stir the fires of controversy, and the reviewer would have preferred to say nothing but what is entirely pleasant and optimistic. But conscience will not let him sign any reference to the book which leaves a reader free to infer that he would accept much if any of the economic doctrine expounded by Professor Schumpeter in his introduction to Part II (entitled "Wages and Capital").

FRANK H. KNIGHT

The University of Chicago

Bevölkerungswellen und Wechsellagen, by Dr. August Lösch. Jena: Verlag von Gustav Fischer. 1936. x, 124 pp. Rmk. 6.

Dr. Lösch, in this publication, the thirteenth of the series edited by Professor Arthur Spiethoff—Beiträge zur Erforschung der wirtschaftlichen Wechsellagen: Aufschwung, Krise, Stockung—does not pretend to present a complete theory of business cycles. He is perhaps more interested in population fluctuations as such than in industrial fluctuations. Yet he does seek to investigate the impact of population movements on business conditions.

He notes that many earlier writers have considered the relation of population growth to the business cycle. But these have usually restricted themselves to theoretical discussions. Factual data have been neglected. These he seeks to supply.

The author is convinced that fluctuations in the labor supply are not the result of the business cycle. These fluctuations, on the contrary, furnish, he thinks, an important part of the explanation of the cycle. The fluctuations in the labor supply emerge from periods of great distress—war, famine, pestilence. Of these, wars have the most important influence. A predicted curve, based on the assumed effect of the early Napoleonic wars and of the "War of Liberation" upon the population of Prussia, is compared with the actual movements of population. These in turn are related to production curves. Fluctuations in the birth rate in Sweden since 1630, and in the various countries of northern Europe from 1816 until the World War, are considered. These are compared with changes in the labor supply 15 years later. Comparison is made with crop fluctuations in Sweden and Germany and with price fluctuations in Sweden. The relation of crops, labor supply, marriage, and fertility rates to climatic changes and war are considered with special reference to Sweden.

The author argues that the growth of population acts as a stimulus tending to produce an upswing in business and that population decline tends to create depression. The growth of population expresses itself in an increased demand for consumption goods, for building construction, and for producers' goods.

That population movements and fluctuations in investment may act and re-act upon one another has long been recognized by business-cycle theories. The interrelation is, however, extremely complex. Dr. Lösch seeks to establish the thesis that population movements are causal factors influencing business conditions but not dependent upon business conditions. Having tried to establish that they are independent of business, he seeks to show that the population-wave movements correlate with business. Thus the conclusion is reached that the former is the cause of the latter. This reasoning is analogous to that of Moore with respect to the relation of rainfall to business. In both cases the statistical basis for the belief in the existence of cycles and their correlation with business is tenuous and uncertain. Moreover, in the case of population there is certainly some causal relation running the other way—from business fluctuations to population. There would be general agreement that both rainfall and population changes affect business conditions, but it is something quite different to argue that the business cycle is rigorously tied to a quite independently determined labor or population cycle.

ALVIN H. HANSEN

University of Minnesota

The Valuation of Property, A Treatise on the Appraisal of Property for Different Legal Purposes, by James C. Bonbright. New York: McGraw-Hill Book Company, Inc. First Edition. Published under the Auspices of the Columbia University Council for Research in the Social Sciences. Volume I, xx, 632 pp.; Volume II, xi, pp. 633–1271. $12.00 per set.

This monumental work is the first comprehensive study of the many ways in which the value of property is conceived and measured in American legal practice. Its purpose is not primarily to advance the theory of value or to suggest improvement in valuation technique but rather to indicate the relationships between various value problems and to offer a comprehensive summary of valuation practice. Incidentally, however, the critical analysis to which current value theory and appraisal techniques are submitted yields results which are well worth the consideration of experts in these fields.

The subject matter of this study is provided by several thousand court cases in which the valuation of property has been an issue in the litigation. In order to deal with these cases and to present an inclusive impression of current thought on valuation it has been necessary for the author and his staff to survey a voluminous literature in the fields of economics, law, accounting, and appraisal. The different approaches of these various disciplines to the value problem are skillfully handled and, although on matter of detail their respective practitioners might object to Professor Bonbright's interpretation, these objections are not likely to be serious.

Perhaps the leading generalization that can be made of this work is that it represents a functional as contrasted with a conceptual or verbal treatment of property valuation. Professor Bonbright's central theme is that the greatest difficulties in the valuation of property are connected with defining the meaning of value and that value can only be defined with reference to the purpose to be accomplished by the valuation. The value of a piece of property can be and, very probably should be, different for purposes of taxation than for purposes of condemnation. Its value for public purchase may be different from its "value" for purposes of rate regulation. In the interests of clarity the terms value and valuation perhaps should be abandoned for a set of terms which reflect these different purposes. This being impossible it is necessary to eschew the sterile verbalism enshrined in the familiar phrase "value is value" and to recognize explicitly the significance of purpose in valuation.

To do so, however, as Professor Bonbright recognizes, is merely to formulate correctly the value problem. The "purpose" of valuation is to be found in the realm of public policy, and, unless the social consequences of one meaning of value and one technique of appraisal can be distinguished from another, no great contribution can be made to "correct" valuation. "Under these circumstances, an intelligent choice of a basis of valuation demands a prevision of its social consequences, in quantitative terms, to which no scientific method gives easy command." The fact, of course, that there are grave difficulties in the way of determining what the value of property *should be* does not, in explaining why property is valued as it is, detract from the importance of recognizing that the purpose of the valuation, together with certain assumptions either implicit or explicit as to what the social consequences of given types of evaluation will be, have a decisive importance in determining the result.

Since the most serious difficulties in valuation are connected with defining the meaning of value, the author devoted Part I of the book to concepts of value. The center of economic interest has always been in the "causes" of value; in an examination of the "forces" which determine value in the market. For one interested in the question of "correct" valuation procedure, the center of interest would appear to be the social consequences of different value concepts and valuation procedures. Although Professor Bonbright is interested in both the causes and consequences, he directs his attention primarily to the questions "What is value, and how is it found?" The answers to these questions are given in the current opinions and practices of accountants, appraisers, and, particularly, lawyers and judges. In the course of the discussion a distinction is made between four basic value concepts: "market value," "value to the owner," "warranted selling price," and "normal value," all of which play an important role in legal economics.

Having distinguished various value concepts, Professor Bonbright turns, in Part II, to a discussion of methods of valuation. Here the accent is upon the evidences of value, and he considers in turn the significance of actual sales prices, original cost, replacement cost, capitalized income, and capitalized earnings. The chapter on depreciation contains a good discussion of the various important concepts of depreciation and is particularly valuable for its treatment of the relation between the views of accountants and appraisers on the meaning and measure of depreciation. Parts I and II cover some 250 pages. The remainder of the two massive volumes is devoted to a consideration in detail of valuation for different legal purposes.

Professor Bonbright attributes the absence hitherto of a systematic treatment of legal valuation to the fact that the "cautious expert fights shy of a problem that involves law, economics, accountancy and commercial appraisal." The relevance to the problem of all these fields of interest certainly makes the task of a reviewer an unenviable one. It needs no very considerable prescience, however, to recognize in this book a notable contribution to legal and institutional economics.

EDWARD S. MASON

Harvard University

The Recovery Problem in the United States. Washington, D. C.: The Brookings Institution, The Institute of Economics, Publication No. 72. 1936. xiv, 709 pp. $4.00.

For the layman this book provides an intelligible discussion of the recovery problem, full of pertinent facts and simple explanations. To the economist it affords a useful summary of the course of events leading up to and carrying through the depression and also a source of estimates on several economic magnitudes of great importance. For the teacher it has possibilities of use as case material.

When political action assumes a leading role in the direction and organization of an economy, the wisdom of such action becomes crucial to the national well-being. And, if in such circumstances "crackpot" ideas on the "economy of abundance," "technological unemployment," and "purchasing power" are seriously considered in support of legislative measures, economists have an obligation to speak out. As long as the education of the public is left to politicians, journalists, lawyers, business men, and even some members of the academic profession without competence in this field, the country will be easy prey for the propaganda of pseudo-economists. In this setting the book is a noteworthy contribution to public education.

The production of this work was planned and directed by Harold G. Moulton; collaborating with him in the writing were Maurice Leven, Leo Pasvolsky, Charles O. Hardy, Malcolm Merriam, George Terborgh, Hugo

Bezdek, Jr., and Kathryn R. Wright. For such a cooperative enterprise the book possesses a high degree of unity and coherence. The treatment of the subject is divided into three parts: first, an outline of "the sweep of world events" leading up to and through the depression; second, a more detailed analysis of the "readjustments in the United States, 1929–36"; and third, an appraisal of the recovery program in this country to date together with recommendations for government policy. Relevant factual material is supplied in abundance to enable the reader to acquire background for the judgment of the issues involved, but theoretical argument is generally restricted to fundamentals which the layman can readily understand. Problems of economic reform are given attention only in so far as they are related to recovery.

Most economists would subscribe to all or nearly all of Moulton's recommendations: reestablishment of a balanced Federal budget; maintenance of a fixed gold price and stable foreign exchanges; extension of reciprocal trade agreements to encourage international trade; preservation of the "favorable" ratio of wage rates to prices and its future increase through price decreases to spread the benefits of technological progress; maintenance of the prevailing hours of work; elimination of industrial practices—private and public—which restrict output or prevent the increase of productive efficiency; shift of the emphasis in agricultural policy away from curtailment and toward expansion of production.

The favorableness of the existing ratio of wage rates to prices may, however, be questioned. It is true that the indexes of average productivity per labor hour and "product wage" (average hourly earnings divided by price index of finished products) in manufacturing have recently had closely corresponding movements and apparently stand at parity in relation to each other (charts on pp. 258, 261). But this appearance is misleading, since the reabsorption of the idle with a 15 per cent increase in employment would substantially reduce the average productivity per labor hour. This and the obvious fact that relatively high-priced factors tend to be economized constitute reasonable grounds for doubting that the present wage-price ratio is favorable to recovery and for suspecting that a continuation of the administration's high wage-rate policy may cause a large volume of permanent unemployment.

THEODORE O. YNTEMA

University of Chicago

Banking and the Business Cycle, A Study of the Great Depression in the United States, by C. A. Phillips, T. F. McManus, and R. W. Nelson. New York: The Macmillan Co. 1937. xiv, 274 pp. $2.50.

According to the authors, the chain of causation of the Great Depression ran somewhat as follows: Following the war, prices did not return to a "normal" level. They would probably have done so had it not been for the very large expansion of bank credit which led to a huge "investment inflation." This rapid expansion of bank credit was due primarily to the policies of the Federal Reserve Board. The large imports of gold during the war made it possible to erect a vast superstructure of bank credit upon the gold base. But had it not been for the actions of the Federal Reserve Board, through its open-market policy, in forcing additional reserves on the member banks in 1922, 1924, and 1927 the expansion would have been much less. Excess reserves drove the banks into the investment market, and bank credit poured in steadily rising volume into capital-goods industries, real estate, and the stock market. It was the hyper-elasticity of the Federal Reserve system that made it possible. It was a "central bank inflation."

The Board's great mistake was its attempt to stabilize the wholesale price level. "It is the writers' opinion that we witnessed from 1922 to 1929 the world's greatest laboratory experiment with a 'managed currency,' *within* the gold standard, involving stabilization of the price level. And, to repeat, the view is advanced that the greater part of our recent troubles was the outcome of that stabilization experiment" (p. 181). It was this policy that prevented the much-needed further decline in prices after 1923. It produced the "disequilibrium between saving and investment that constitutes the heart of the boom."

The purchase of investment securities by banks creates deposits just as surely as do commercial loans. Using their excess reserves to buy bonds the banks brought about a divergence between the natural and the market rates of interest. This heightened profit-making possibilities for entrepreneurs who undertook new capital expenditures. New bond issues appeared, and the purchase of them by the banks created still more purchasing power and upset the equilibrium between investment and saving. Prospective profits of entrepreneurs then became actual profits. The income of the public was increased, and the rate of increase of investment was accelerated. And so it went on until the *rate* of increase began to slacken.

Profits from stock market speculation (supported by bank credit) kept buying power at a high level even after business and construction activity began to decline. Then the stock market collapsed. This collapse gave a severe shock to general confidence and also resulted in a great loss of consumer buying power. "In this sense, the stock market crash may be considered the immediately generating cause of the ensuing depression" (p. 159). Had it not been for Federal Reserve expansion in 1927 the stock market would not have risen to such unprecedented heights. What the Federal Reserve system did was to prolong a boom which, otherwise, would probably have come to a natural end in 1927. The effects, naturally, would have been much less disastrous, and the collapse of the banking system probably avoided.

Once the depression was well under way liquidation and the restoration of an equilibrium would, possibly, have proceeded in an orderly manner had it not been for another blunder—the attempt to keep wages up. It is the authors' belief that had this mistake not been made we should probably have escaped the terrors of 1932 and the New Deal.

Now, they believe, we are making another grave error by trying to spend our way back to prosperity. "By consuming more than we have produced we have succeeded only in digging our way deeper into depression; we have tried to recover from depression by spending our way out of it rather than adopting the alternative procedure—the one which has effected recovery from every past depression—of *saving* our way out of it" (p. 165). What we should have done was to bend our efforts toward a revival in the capital-goods industries. "Instead, all efforts were directed toward bolstering up consumption."

High wage rates do not constitute high purchasing power. Wage rates in many industries, especially the construction industries, must come down. "What is hoped to be accomplished by a reduction of wage rates is an increase of aggregate purchasing power" (p. 222). Otherwise we shall probably have a long period of high and continued unemployment, because business cannot give full employment at present wage rates. We need lower costs in capital-goods industries. "Here is a brief and conclusive answer to the whole question of the consequences of artificially maintained consumption—*With labor receiving a greater percentage share of the total social product than at any time in recent history, the result was widespread unemployment and stagnation.* The way out is *via* greater production, a larger total social product, and that necessarily follows upon a greater amount of saving being made *and* converted into investment goods" (pp. 166–167).

Price stabilization as a policy, they conclude, must be abandoned. What we need is control of the *total amount of credit.* The ideal aim of credit policy should be to *stabilize the rate of credit growth.* Credit growth should proceed at the same rate as the growth of population. This would result in a practically constant money supply, an approach to "neutral" money. Changes in velocity need not cause anxiety, for under these conditions there would not be great variations in velocity. A falling price level might result, but there is much to be said in favor of a slow decline in prices, when, because of technological improvements, production is increasing.

Finally, present government policies of financing the deficit by loading up the banks with bonds are bringing about another inflation of bank credit. We may have to repeat the experience of 1929–1933 if we continue on our present road.

The authors are to be congratulated for having written a book which attempts to tell what has been wrong with us for the past decade and to point out what is *still* wrong with us. The reviewer agrees with their emphasis upon monetary and banking factors in bringing about our troubles. Recognizing with Cassel that "the present crisis is, in fact, a crisis also for the entire theory of business cycles" (quoted on p. 3), they have made a valiant attempt to give us an explanation of the forces that have been at work.

They frankly admit that they have not tried to expound a new theory but to piece together an eclectic one gathered from many sources and the work of many others. Their indebtedness to B. M. Anderson, Jr., Hayek, and Keynes is freely admitted. They have tried to integrate theories that they believe have previously been regarded as conflicting—the monetary, the structural, and the equilibrium theories. Well written, well organized, logically expounded, and based upon wide reading and research, the contents of this book should receive wide attention. It contains much of real value.

I wonder, however, whether the authors have read Chapter XVIII (Economic Progress and Falling Prices) and Chapter XIX (Consequences of Various Forms of Price Stabilization) in Alvin H. Hansen's "Economic Stabilization in an Unbalanced World." If they have, I do not believe they have considered fully enough the dangers of a period of falling prices, so ably pointed out by Hansen. Also, what is the mechanism by which we can guide the growth of credit at the rate desired by the authors? Do we not need *qualitative* as well as *quantitative* control? The views of Hayek are now coming under increasing criticism, and Keynes has again changed his definitions so that now, he says, saving and investment are always equal.

Was the postwar price level really too high? Is it sufficient to compare the movement of prices in other postwar periods with this one? Had prices kept on steadily rising at the same rate as from 1900 to 1914, as they might have done had there been no war, the postwar level was not far above what might have been expected.

Are the authors on sound ground when they pay so little attention to international factors? Were the policies of the Federal Reserve Board responsible for the *world-wide* collapse? There is considerable room for doubt. Where did the depression first begin, and what was the chain of causation by which it spread from country to country? It is expecting too much of the authors to ask them to give us this information, I know, but it would help a lot to have it. Furthermore, it seems strange that a book coming out of Iowa should pay so little attention to the agricultural depression beginning in 1920 and the part it played in bringing on the collapse in 1929. Surely, it was a slip of the pen to write that the number of bank failures in 1931 "was greater than the total for *all* the years from 1900 to 1929" (p. 168). And did the stock market or did it not absorb bank credit?

I wonder if, before the authors begin to "universalize" their conclusions on the period from 1924 to 1932 to explain previous depressions, it might be desirable to make a similar study of those earlier depressions. It may be that we have had at least two types of cycles, that the long depressions of the forties, the seventies, and the nineties arose from somewhat different causes than those of 1884, 1907, and 1921. Why is it that our longest and most severe depressions have followed a period of relatively stable or slowly falling prices?

It is curious that Tugan-Baranowski, Spiethoff, and Schumpeter are not mentioned in the volume. The reviewer would have been interested in what the authors think about Major Douglas and Social Credit.

The reviewer agrees with the authors in wishing that the depression could have been permitted to cure itself by the same remedies as were applied in the past, if only to see whether it could do so. But, for the first time in modern history, the majority of the people in most leading countries insisted that their governments should take steps to restore prosperity. That being true, it was politically impossible to let things alone. Governmental *spending*, therefore, became imperative. The government had to produce results. As much as we may dislike to see it, the world moves steadily closer to governmentally managed economic systems, for the rising power of trade unionism prevents wage decreases. Peoples demand economic security and expect the government to furnish it. And because things do not go in the way the government hopes for, the government tries to straighten out the mess by doing still more. It may, therefore, be a long, long time before another depression is permitted to cure itself. What kind of business-cycle theory will develop out of all this, it is yet too early to tell. But I suspect that a theory which would apply to an economic system based upon a high degree of individualism and competition will not be appropriate in the years immediately ahead. And the lot of the business forecaster will be an even unhappier one than it has been in the past.

CHARLES S. TIPPETTS

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Public Finance, by Alfred G. Buehler. New York: McGraw-Hill Book Company, Inc. First Edition. 1936. xix, 632 pp. $4.00.

This college textbook is in the main arranged along lines that have apparently become standardized for public finance texts. Although chapters are not formally grouped, the customary order of introduction, expenditure, revenue, and debt is followed.

The book begins with a discussion of the nature and functions of the state and a description of the fiscal organization of governments. Seven chapters are devoted to expenditures, after which are placed two chapters on Federal and state and local enterprises, which are treated with respect to both their revenue and expenditure aspects. Fourteen chapters deal with taxation. Administrative revenues and special assessments are included in one of the chapters on taxation, no doubt for convenience as the location is not a logical one. Five chapters on borrowing conclude the book.

No group of chapters is devoted specifically to financial administration in contrast to recent practice in some texts. For an author to decide if and how financial administration should be discussed separately from the activities being administered is no doubt difficult. The solution of Professor Buehler is perhaps as happy as any. He presents a chapter on general administrative organization of finance early in the book and introduces at appropriate points other chapters and sections on the administration of different financial activities. Perhaps unfortunately, the chapter on general administrative organization is mostly descriptive; it does not include an analysis of the functions to be performed and the problems to be solved by financial organization.

The emphasis throughout the book is on American conditions and problems although references to foreign practice are frequent. For the most part factual information has apparently been revised to about the middle of 1935, although in some cases the data are much more recent. In a few other cases less recent developments appear to have been overlooked.

Economic aspects of finance are considered somewhat more fully than is often the case in public finance texts. There are, for example, analyses of the relation of taxation to the business cycle (p. 494), of the economic aspects of unemployment relief (p. 127), and of the relation of borrowing to the distribution of wealth (p. 610). Subjects of recent interest such as control of governmental expenditures, conflicting Federal and state taxation, subventions and subsidies, the undistributed profits tax, taxes for old age pensions, and so on, are discussed.

Theoretical issues are in general well handled although there are exceptions. For example, taxes are said to be shiftable "only when they are imposed under conditions permitting a restriction of supply and a raising of prices" (p. 234). This limitation necessarily excludes backward shifting, which, however, is stated earlier to be one form of shifting (p. 230).

The style of writing is clear and simple. Words are used economically. Occasional sentences and paragraphs could, however, be improved.

The opinions of the author on public policy do not intrude to an unreasonable extent. Indeed, he appears to have been careful not to pass judgments unnecessarily. Such opinions as are expressed indicate a middle-of-the-road position.

This book is a substantial achievement and a welcome addition to the literature of the field.

ROY BLOUGH

University of Cincinnati

The Purchase of Common Stocks as Trust Investments, by C. Allison Scully. New York: The Macmillan Company. 1937. ix, 82 pp. $1.00.

In this excellent little book, Mr. Scully, a vice-president and trust officer of Bank of the Manhattan Company, New York, deals basically with the question of "whether a trustee is authorized and permitted to buy common stocks without being personally liable in case of loss." The book begins with a brief review of the development of trust concepts from the restrictions of feudal times to the more liberal views of the present day. The author finds that, contrary to popular belief, there is no rule of law holding that common stocks are not at any time or under any conditions a suitable investment for trust funds or that a trustee who buys them does so at his peril. As the best formulation of the rule he quotes from the Restatement of the Law of

Trusts by the American Law Institute, Tentative Draft No. 4, "the trustee is under a duty . . . to make such investments and only such investments as a prudent man would make of his own property having primarily in view the preservation of the trust estate and the amount and regularity of the income to be derived."

There follows a discussion of the possible adverse effects of devaluation and potential inflation on the purchasing power of income derived from the traditional fixed income trust investment instruments and on the real value of the corpus itself. He concludes that there is danger in this country of material loss to the beneficiaries of trust estates unless the trustees of these estates are able to diversify the trust investments so as to include the purchase of well-selected common stocks.

Provided common stocks fall within the definition of eligible investments, by terms of the will or deed and under the statutes of the state having jurisdiction of the trust, Mr. Scully believes that trustees may properly include among trust investment purchases those common stocks which meet certain tests of business judgment offered in the book.

The book will be useful to trustees generally. Though it is not the answer to a trust officer's prayer, it will lend him comfort until the answer comes.

Carroll D. Simmons

The University of Texas

The Theory of Gold Supply, with Special Reference to the Problems of the Witwatersrand, by W. J. Busschau. New York: Oxford University Press. London: Humphry Milford. 1936. Oxford Studies in Economics. General Editors—D. H. Macgregor, G. D. H. Cole, J. Marshak. x, 193 pp. $3.75.

This volume is an application of economic, actuarial, and accounting theory to the gold-mining industry, covering such problems as the valuation of gold-mining properties, the determination of income from mining operations, the most profitable rate of exploitation of mineral resources, the determination of the grade of ore worked, and the taxation of mines. Although in general the principles set forth apply to all types of mining, the illustrations are drawn chiefly from the South African gold-mining industry, and the two chapters on taxation are written entirely in terms of the tax laws of South Africa.

The discussion is highly technical and very compact. In undertaking to review it I must confess that I have been content to take samples of the ore it contains and block out the content without attempting to exhaust the workings. These test borings indicate a high-grade deposit with long prospective life, a low risk factor, but high labor costs of exploitation.

A disappointing feature is the failure to discuss adequately the peculiar response of South African gold production to the stimulating factors which have been in operation since 1930. Between 1929 and 1935 the output of the South African mines rose by only about 3 per cent, though the production in Canada increased by 70 per cent, that of the United States by 50 per cent, that of Russia by 450 per cent, and that of the world outside of South Africa by over 100 per cent.

The stability of South African production has been the resultant of a large increase in tonnage worked and a compensating fall in the average grade of the ore, a fall which was not at all foreshadowed by developments prior to 1930. One would expect, of course, that falling costs in 1929–1932 and the rise in the price of gold at the end of 1932 would cause a decline in the average grade. Previously submarginal ores became profitable and the working of such ores necessarily diluted the average. But a substantial fall in average grade due to this factor alone would require a large increase in the total output of gold. Obviously, what has been taking place is not merely dilution by adding low-grade ore to the previous output of high-grade ore but a concentration of effort in the poorer areas and a conservation of the higher-grade ores. Such a shift has been an objective of governmental policy, and the tax laws have been shaped to this end, but the volume under review fails to make clear whether the tax factor is adequate to account for the actual decline in the utilization of high-grade ore. At one point (page 93) the author lends his support to the widely accepted but fallacious theory that when costs are expected to rise [or the present price of gold to decline?] it will pay to work low-grade ores first lest they later become valueless. It is true, of course, that a rise in costs may cause deposits now profitable to become submarginal. This is an economic reason for expanding the scale of operations when costs are low, but it is not an economic reason for postponing the exploitation of high-grade ore; the added costs that will later make low-grade ores worthless will correspondingly reduce the value of high-grade ores. Anticipated changes in costs may determine the profitable scale of operations in the present, but they do not affect the profitable order of exploitation. In so far as that is subject to control at all, the controlling factor is the saving of interest from maximizing the earlier dividends.

The analysis of the anticipated rate of return required to induce speculative investment (pages 9–10) is not sound. Referring to the fact that the speculative rate necessary to induce investment in risky enterprises falls with the lengthening of the term of investment, the author says: "This is due to the fact that the longer the period the greater will be the contribution those destined to fail make during their success." But the table of speculative rates under discussion (quoted from D. C. Fraser) does not involve the assumption that the unsuccessful investments yield a return. It is computed on the assumption that the unsuccessful enterprises do not return either principal or interest, whereas the successful enterprises yield the speculative rate for a specified term of years and then return the capital intact, both the dividends and the return of capital being discounted at the safe rate.

The footnote on page 10 adds to the confusion, since the speculative rate is computed without any allowance for the loss of capital in the unsuccessful ventures. The formulae given can be justified only on the assumption that the unsuccessful ventures return their capital intact at the close of the period of exploitation or, what comes to the same thing, that the successful ventures yield the speculative rate in perpetuity—an assumption which is, of course, inconsistent with the character of the mining industry.

CHARLES O. HARDY

The Brookings Institution

Banks, Credit, and Money in Soviet Russia, by Arthur Z. Arnold, with a foreword by H. Parker Willis. New York: Morningside Heights, Columbia University Press. 1937. xxiii, 559 pp. $4.00.

Mr. Arnold has written the first really comprehensive account in the English language of the Soviet monetary and credit system. It is true that that system has been briefly described and analyzed in a number of recent publications, and the very readable book by L. E. Hubbard which appeared in England last year cast a good deal of light upon the theory of the Soviet financial system. Mr. Arnold, however, set himself the rather different and much more complicated task of explaining the Soviet money and banking system by showing in detail how it developed through trial and error and the application and abandonment of various theories. The general treatment throughout is historical, beginning with three useful chapters on Russian banks, credit, and currency as they functioned before the advent of Communism. On the basis of official documents, and guided also by numerous other studies of Soviet monetary and credit problems, the author gives a detailed account: (1) of the nationalization and liquidation of the prewar banking system; (2) of the inflation of the "sovznak" or paper rouble during the period of so-called War Communism in 1918–21; (3) of the reasons underlying the creation of the State Bank in 1921 and of a new monetary unit, the chervonetz, in 1922; (4) of the difficulties encountered during the early years of the N.E.P. (1922–24) in making the new dual currency system function satisfactorily; (5) of the agony of the sovznak, its replacement (in the ratio of 1:50,000,000,000) by a new "gold" rouble, and the issuance of Treasury coinage in 1924; (6) of the evolution of the State Bank and the organization and growth of other Soviet banks; and (7) of subsequent developments in the fields of money, prices, and gold. The book is wound up by an excellent summary and an impressive bibliography.

One of the pertinent facts which Mr. Arnold brings out is the illusory nature of the theory held by some that the Communist régime deliberately sought to destroy the value of the sovznak. He shows that the abolition of money was not an immediate aim of the Soviet authorities, but only an ultimate ideal, and he explains how even Bolshevik economists were misled by the inflation and its concomitants into believing that money was soon to be permanently dispensed with. Considerable space is devoted to the unique currency system of 1922–24, in which a rapidly depreciating sovznak was circulating alongside a slowly depreciating chervonetz, that is, two paper media rather than two metallic media of payment were in circulation on what Mr. Arnold calls a "bi-paper standard." The fact that the chervonetz bank notes did not depreciate as rapidly as the Treasury's issues of sovznaks appears, from this account, to have been due principally to the circumstance that the State Bank restricted its issues in order not to exceed the legally prescribed ratio between its metallic reserve and its notes. Both the chervonetz and the sovznak were inconvertible, but the issue of sovznaks had been freed from all restrictions and was, besides, the principal source of budget revenue.

With respect to the relationship between the chervonetz and the present rouble, however, Mr. Arnold gives less information than some of his readers may wish to have. The explanation is perhaps that, as he says, the Government's decree of February 5, 1924, ordering the introduction of the new rouble failed to state what the relationship was to be. Apparently no legal ratio of exchange between the two currencies has ever been fixed, although the State Bank has always effected conversions freely at the rate of 10 roubles to one chervonetz.

Soviet methods of planning are explained in this book to the extent that an understanding of them is essential to a grasp of the banks' functions. One comes away with a clearer conception of the gulf which separates Soviet banking from capitalist banking, owing to the subordination of Soviet banks to the whole scheme of planning. As Mr. Arnold summarizes the position of the banks in Communist Russia:

> They are not free entities to do as they please. . . . Their plans, like those of other enterprises and institutions, must be in line with the general policy. If their resources are not adequate to permit such compliance, the government will either provide them with additional means or, if that is impossible, tone down the projected expansion. Although they are permitted and even required to earn profit, this is not at all their leitmotif. It is a side issue with them. They have no choice whatsoever in selecting clients. If a client's approved credit or financial plan calls for a given amount of bank credit or budgetary financing, the bank in question must grant it, even though it may later invoke certain well-defined sanctions against him for non-compliance with the provisions governing the repayment or the use of such funds. Nor is the Soviet discount rate intended as a regulator of the volume of credit and currency, and of the flow of foreign funds to and from the country. Its sole purpose is to enable banking institutions to be self-supporting and to accumulate reserves.

From the above and the rest of what Mr. Arnold has to say on this subject, one comes to the conclusion that Soviet credit institutions are in reality more nearly branches of the Finance Commissariat than they are banks in the accepted sense of the word. But the author himself points out that the goodness or badness of a banking system depends less on the underlying theories or principles of the system than on how well it serves the needs of the particular economy for which it is designed. Without passing final judgment on the efficiency of the Soviet banking system, Mr. Arnold expects that, "in the absence of extraordinary happenings," that system will continue in the near future to develop along the present lines.

On that aspect of the Soviet monetary position which is perhaps of the greatest current interest—the size of the gold reserve and the volume of gold production—this book throws no new light. The author confesses that the size of the Treasury's gold stock (i.e., apart from the State Bank's holdings) is unknown. Estimates of annual Russian postwar gold production made by other experts are to some extent reproduced and correlated.

Although Mr. Arnold cannot be accused of bias in respect of the Soviet State, some of his passages leave no doubt in the reader's mind that his economics are, on the whole, orthodox. These passages appear to be aimed at those who would attempt (or have attempted) monetary experiments in the United States rather than at the Soviet scheme of things. For instance, Mr. Arnold warns that, once a country is off the gold standard and its currency unredeemable, the possession of a gold reserve "no matter what its size" is an inadequate protection against inflation. He is of the opinion that "once inflation gets well under way it cannot be 'controlled' or stopped at will," largely because the preliminary step to such control—balancing the budget—cannot be accomplished overnight. At the same time, his criticism of certain phases of the Soviet economy and his praise for the comparative merits of certain policies adopted both proceed from an objective examination of the facts. After explaining the shortcomings of planning in the period preceding the Five-Year Plan, he adds sympathetically, "but just the same, planning in the Soviet Union is steadily improving . . . and even in its imperfect state it has proved of inestimable value to the economy of the country. The present planning apparatus and the planning methods employed today are far more scientific, far more complex, than they were during the earlier years of their evolution." In the light of the latest press reports of industrial confusion in the Soviet Union, this statement appears to err somewhat on the side of generosity.

Mr. Arnold's volume contains numerous statistical tables which will be found extremely useful not only by the student but for general reference purposes.

O. Ernest Moore

Federal Reserve Bank of New York

Land Utilization and Rural Economy in Korea, by Hoon K. Lee. Chicago: The University of Chicago Press (The Baker & Taylor Company, New York). Issued under the Auspices of the Secretariat of the Institute of Pacific Relations. 1936. xii, 302 pp. Appendices, maps. $3.00.

Considerable interest has developed in recent years in far eastern economic problems, but the emphasis has been very largely upon China, Japan, the Philippines, and the Dutch East Indies; and Korea, except as a colony of Japan, has been overlooked. Most of the information on Korean economics available in a western language has come from the Government-General's publications, and there has been almost nothing from Korean sources. Hoon K. Lee's study of land economy in Korea, therefore, comes as a welcome and much needed addition to our knowledge of Korean economics. It is a very honest piece of work, presented by a Korean scholar who has successfully subordinated political considerations.

The study was made in 1931 and 1932 and is based upon the examination of official documents and other literature and also upon a field survey which was conducted with the aid of 41 field workers using carefully prepared schedules. The sample is not large in relation to the total population, but it reveals important factors obscured in the statistical reports of the government. It would have still more value if the author had given a fuller account of the character of the farm households included and the determining factors of selection. For example, the field survey reveals a very much higher yield per acre for the major crops than has been yearly reported in the government statistics. The author states that the government statistics are based upon data reported by village clerks as their superficial judgment of the crop and without actual surveys. His field survey shows, in the case of rice, a yield 68 per cent greater than the government figures. With such a wide discrepancy in yields, it is important to know exactly the character of the farms included and whether, by some unconscious factor, they have been selected from the upper levels of efficiency, or if they are truly representative of Korean agriculture.

The statistical presentation, in general, is simple and definite. In measuring efficiency of farm labor, however, a fuller account of the character of the sample should have been given to aid the reader to evaluate the findings. The conclusion, on the basis of the data presented, that "the efficiency of women and juveniles is little more than one half that of adult men," is open to question. The maps in general are poorly conceived and do not give the instant graphic representation intended. Their fault is in the technique of construction, not in the data.

The first chapter, which presents the basic facts of climate, topography, resources, and population, is the poorest of the chapters and could have been omitted as most of the data presented are well-known and readily available. The historical data on population have not been sufficiently analyzed in the presentation for trends of population growth to be established from them. Large fluctuations in the figures suggest possible changes in the method of enumeration or other statistical faults. These criticisms, however, are minor to the main body of the work.

The study really begins with a second basic chapter on the characteristics of Korean agriculture and then goes on with a consideration of the problems of land utilization and ownership and related questions of capital investment in the land, rural credit, farm income and expenses, marketing of farm produce, and farm labor. Problems of tenancy are well presented and reveal a striking similarity to tenancy problems in China and Japan. There is also an interesting chapter on the standard of living, showing the decreasing per capita consumption of rice and the shift to millet. The last chapter deals restrainedly with the bitter problem of Japanese colonization in Korea.

The study is not exhaustive, but it is suggestive, and Professor Lee has done an excellent piece of work. He has opened up the field for Western students and has disclosed many problems, not only of importance in their relation to Oriental economy but in the universality of their occurrence.

JOHN E. ORCHARD

Columbia University

The Economic Position of the Chinese in the Netherlands Indies, by W. J. Cator. Chicago: University of Chicago Press. 1936. Issued under the auspices of the Secretariat of the Institute of Pacific Relations by Basil Blackwell—Oxford. xi, 264 pp. $3.00.

The Southeastern corner of Asia, which has long been overshadowed by more spectacular events in other parts of the Far East, is emerging from its neglected position. With the freedom of the Philippines being much discussed of late, and with the noticeable progress of Japan's southward expansion, an increasing interest is being taken in this part of the world. The German-Japanese agreement against the Communist International, which was signed at the end of 1936, was reported to contain a secret clause aiming at the division of the Netherlands Indies into spheres of German and Japanese interest. Evidently there is no place where friction between West and East is more likely to develop than in these vast and rich tropical island possessions which are owned by a small western nation, threatened by Japan, and, probably, protected by British fortifications at near-by Singapore.

With the international scene changing so rapidly, it is of importance for any observer to know more of what is going on inside those Dutch islands, which are inhabited by 65 million people. An interested public, therefore, will gladly receive Mr. Cator's contribution dealing with the foremost and most complex interior problem of the archipelago. There have been large Chinese settlements on the islands ever since, under the reign of Kublai Khan, a Chinese expedition of 20,000 men was dispatched to Java in the 13th Century. With the coming of the United East India Company, which was the forerunner of Dutch colonial rule, these Chinese merchant communities enjoyed many advantages from the Company's permanent friendliness toward them. The Dutch recognized the fact that the Chinese, "as merchants, far exceed ours in ability." The protracted war between the Ming and Manchu dynasties that swept the coastal regions of Southern China helped to increase emigration from those provinces (chiefly Kwangtung and Fukien) to Java which is one of the most fertile islands of the world. Here the thrifty and energetic newcomers succeeded in penetrating the commercial life of the archipelago. As agents of the Dutch, especially of that "mighty wholesale dealer," the East India Company, the Chinese had achieved, toward the end of the Eighteenth Century, complete economic domination of the native population in the field of trade and, in some regions, also in the fields of agriculture and industry.

Today there are one and a half million Chinese inhabitants in the islands, who have retained their economic position amounting to a practical monopoly in the retail trade of the colony. Immigration from China is still going on, although to a lesser degree owing to recent restrictions by the Dutch authorities. In 1930, 63 per cent of the Chinese population in the Indies had been born there. These Chinese, even if admitted to Netherlands Indies citizenship, have kept the characteristics of a national minority. Of special interest is their connection with the Chinese Government, a point emphasized by Mr. Cator. There is a tendency, on the part of China, to take advantage of this group which has retained Chinese nationality according to the Chinese law, in order to increase exports from China to the Indies. Funds are being collected, by the Chinese Government, for numerous purposes including the purchase of war material, and several organizations in the Indies aim at strengthening the ties with China. Another aspect which might assume international significance is the connection among Chinese trading communities in different countries of Southeastern Asia. For example, one of the products handled by Chinese wholesale dealers in the Indies is rice, which is imported from Siam and Indo-China where intermediate and wholesale trade is also dominated by Chinese merchants.

Lack of capital and the dominant position of Western wholesale traders has largely restricted Chinese commercial activities to the field of retail trade. Here the Chinese merchant is superior to his native colleague because of an "inborn flair for business, and perhaps also on account of his other natural aptitudes." The European merchant, too, cannot hold his own against him because of the closer contact between the Chinese and the consuming native communities. In addition, the Chinese have cultivated an *esprit de groupe* which has developed closely interlocked communities of interest in the fields of commerce, agriculture, mining, and industry. This type of organization has proved to be the safest bulwark against interference with the Chinese trade monopoly, aimed at by Japanese competitors as well as by native co-operatives. The well established position of the Chinese community in dominating the profitable intermediate trade of the archipelago does not show any sign of breaking up.

The Dutch authorities have recognized the position of the Chinese community as an asset and a source of colonial prosperity. Although the Chinese are subject to legal provisions for foreign Asiatics, little grievance has been caused by discrimination, especially since no racial criterion has been adopted in the immigration policy of the Netherlands Indies. The Chinese, on their part, have been law-abiding. Allegations made by Mr. Cator as to the "grateful use of European bankruptcy law" made by the Chinese are contradicted, a few pages later, by the explanation that a great number of Chinese bankruptcies may be regarded as an immediate outcome of the lack of available reserve funds. On the whole, however, Mr. Cator succeeds in dealing objectively with the questions involved, although a more critical, at least a more extensive elaboration of the Dutch administration's policy with regard to these 1,500,000 strangers might be desirable.

Mr. Cator's book is a valuable contribution toward understanding of the changing scene in the Far East, where the importance of racial contacts as a factor of political and economic developments is being increasingly recognized. The "extremely dynamic character" of this racial group, emphasized by this study, is apt to stimulate human interest in Far Eastern problems, which cannot be sufficiently understood through a purely scientific way of approach.

ERNEST O. HAUSER

Institute of Pacific Relations
New York City

Social Work Year Book, 1937. New York: Russell Sage Foundation. Edited by Russell H. Kurtz. Part I. An Authoritative Record of Organized Activities. Part II. A Directory of 1,020 National and State Agencies in Social Work and Related Fields. Fourth Issue. 1937. 709 pp. $4.00.

This issue of the Year Book, which is published biennially, is the first issued under the editorship of Russell H. Kurtz. The earlier volumes published in 1929, 1933, and 1935 were edited by Fred S. Hall, who retired recently. The present volume follows the same general plan as the 1935 publication. A number of new articles have been added, some materials have been reclassified, and various articles have been revised. Probably the most significant new feature is to be found in the eleven articles on the social security program of the Federal Government. Significant, too, are the new articles in the field of public welfare services.

Part I entitled, "An Authoritative Record of Organized Activities," contains signed articles by 120 authorities on the subjects covered. The value of this part, which comprises more than 500 of the 709 pages of the Year Book, is enhanced by the classification of the topical articles in eleven groups: Planning and Support of Social Work; Child and Family Services; Social Security (Federal Program); Public Relief; Handicapped, Racial, and Foreign Groups; Delinquency and Crime; Health and Mental Hygiene; Labor and Industry; Leisure-Time and Group Activities; Social Work under Specified Auspices or in Specified Areas; and Personnel. The articles are of variable lengths, each usually adequate for the subject considered and with a bibliography at the end. Taken as a whole the articles deal with definitions, problems, programs, history, trends, finances, and present status of subject considered.

Part II of the Year Book, a directory of 1,020 national and state agencies in social work and related fields, describes the nature of 395 national agencies, public and private, 573 public state agencies, and 52 state-wide private agencies. The description of each agency when complete covers the address of the agency, the year of organization, the executive officer, the membership, the purpose, the activities, and the periodicals published. Incomplete information on some of the agencies reduces somewhat the value of this material. This directory has been extensively revised since 1935 to make it an up-to-date and useful guide to organizations. The index to the volume is an aid to the systematic use of the directory as well as Part I.

Taken as a whole this Year Book is an improvement over previous volumes. Students of the social sciences, social workers, librarians, editors, and other professional groups will find this volume an indispensable handbook for reliable information in the broad and expanding field of social work.

VERNE WRIGHT

University of Pittsburgh

Real Property Inventory of Allegheny County. Publication of the Bureau of Business Research, University of Pittsburgh. (Statistical Handbooks Number 3.) March, 1937. x, 311 pp., 5 maps. $5.00.

Vital information concerning housing and important indices of the planes of living of families in each of the 490 census tracts in Pittsburgh and the rest of Allegheny County are shown for February, 1934, on the 253 pages of tables, illustrated on the 51 pages of maps, and described in the 10 pages of explanatory text.

Comprehensive information is given for each of 490 small areas in Allegheny County regarding dwellings, including their age, type, chief material of construction, condition, use, and, if owner-occupied, value. With respect to family units, data are shown on occupancy and vacancy, size as measured by number of rooms, heating, lighting, cooking, bathing and toilet facilities, the period of occupancy or vacancy, and, if rented or for rent, the asked monthly rental. With respect to families occupying dwelling units, data on race, number of persons in family, persons per room, and mode of transportation used by principal income earner to get to work and time required are shown.

These and other data were obtained by men and women employed by the Civil Works Administration and supervised by the research staff of the Bureau of Business Research of the University of Pittsburgh. In this survey the forms prepared by the Bureau of Foreign and Domestic Commerce for use in the Real Property Inventories made by the Government in 64 cities in the United States were used with no modifications except in the heading. The data for the Real Property Inventories taken under Federal supervision have been published by the Bureau of Foreign and Domestic Commerce for each metropolitan district, for each central city, and for the area outside of the central city but within the metropolitan district. For none of the 64 cities, with the exception of Cleveland, were these totals tabulated and published by the small, geographically constant areas called census tracts as they are in this locally supervised survey.

The totals for Allegheny County show that 82,754 families were without tubs or shower baths and 3,569 families had three or more, 136,566 families were without central heating facilities, and 3,952 owned homes valued at $20,000 or more. The totals are interesting, as are those for each of the 64 Bureau of Foreign and Domestic Commerce cities, but the numbers in each census tract or other small area are ever so much more interesting, and such detailed data are much more vital to all those interested in the Greater Pittsburgh area. For example, 97 per cent of the families in one census tract in Pittsburgh had no tubs or shower baths, while 100 per cent of the families in other census tracts had one or more. One hundred per cent of the families in three census tracts were without central heating facilities, while only 0.2 per cent of those in another were in this condition and 75 per cent of the families in this latter census tract lived in single-family dwellings valued at $20,000 or more.

Such detailed data as these are of value to public and private organizations concerned with the development of the city and surrounding area, to social and health agencies, to realtors, to financial institutions, and to intelligent merchandisers. Public officials, welfare workers, and business executives will all profit greatly by studying intelligently the basic data presented on the pages of this volume. All terms are clearly defined, the tables are easy to understand, and the maps not only are attractively presented but each tells an interesting story.

Although some of the data are already obsolete, such as those relating to vacant family units, most of the data are still pertinent and will remain substantially so for some time. While several tables show percentages instead of numbers, one table combines numbers on the left side and percentage bar charts on the right, making it possible to grasp easily the relative conditions in each census tract. The final tables show nonresidential units by type of use.

Data comparable to these are available in fewer than a half dozen American cities and for but two greater city areas, namely, the Cleveland Metropolitan District and Allegheny County. No attempt was made to interpret the data. Had such an attempt been made, several additional volumes would have been necessary.

HOWARD WHIPPLE GREEN
Real Property Inventory of Metropolitan Cleveland

Plans for Stimulating Suggestions from Employees, by F. Beatrice Brower. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies Number 231. October, 1936. viii, 51 pp. $2.00.

This is a monograph based on a survey of the experience of 338 companies operating suggestion plans. The information was apparently gathered solely through questionnaires, without any field work. There are some types of research in which the questionnaire method has decided limitations, and this is certainly one of them. For, although the monograph does contain a useful compendium of the structure of suggestion systems as far as requirements and procedures are concerned, its vital section on the experience with suggestion plans lacks insight because it relies entirely upon what companies themselves report.

For example, of what real value is the specious table on page 42 on the causes of the discontinuance of 116 plans, in which the major items as reported by the companies were 62 cases of "lack of interest," 39 cases of "employee dissatisfaction," etc. Anyone who has ever studied suggestion systems first-hand and in the actual setting knows that they are often so poorly handled by the management that blaming the employees is often an alibi, a rationalization, or at least a faulty diagnosis.

One wonders why so important an organization as the National Industrial Conference Board will continue to make superficial surveys in territories where it should have field studies rather than mere compilations.

HERMAN FELDMAN

Amos Tuck School, Dartmouth College

Classification of Business Literature. Prepared by the Library of the Harvard University Graduate School of Business Administration, George F. Baker Foundation. New York: H. W. Wilson Company. 1937. xv, 257 + 33 + 58 pp., photolithographed. $5.00.

The Harvard Classification is a joint effort of the School of Business Administration and the Baker Library. It is a direct outgrowth of the rapid expansion of the Business School Library, where it has been tested in actual use.

The scheme has a unique approach, being based on four considerations which determine the internal and external relationships of business. These are: (a) the relation of business to other subjects; (b) the element of time; (c) the functional divisions of business activities; and (d) the relation of business functions to particular business institutions. This series of relationships is clearly seen in the main stem of the classification, which contains sections lettered A–Y. If we select those main section headings which use the word business, we find it in five successive groups. (A) Business: generalia and general relations to government; (B) Business and economic theory; (F) Business and economic conditions; (G) Business and economic history; (H) Business organization and administration. It will also be noted in this illustration that sections B, F, and G each provide for a different phase of the relationship between business and economics.

It will thus be seen that the correct classification of material under the Harvard Business scheme will demand careful analysis of the subject matter of each book or pamphlet, as to its relationships. There is, in the usual sense, a departure from the principle of subordination, but there is also an expansiveness which is often lacking in a classification system for a special field.

The main classification (the skeleton structure of which we have just been discussing) has three parts: the subject analysis, for which a letter notation is used; the industries list, which is a decimal scheme; and the local or geographical list, also on a decimal basis. The section of most interest to us is the one lettered D: Methodology of research and control, for it is here that we find in detail the outline for the statistical method per se, lettered DB to DEY.

The main heading is Statistical Methods. The headings next subordinate, and commensurate with each other, are Statistical theory, Units of measurement, Data collection, Statistical tables (methods of construction), Statistical operations, Statistical analysis, Use of statistical methods as a tool in business and price forecasting, and Graphic representation. Let us select two of these groups for more detailed examination: DC: Statistical analysis, and DE: Graphic representation. Under DC we find, in turn, five subdivisions: Frequency distribution, Time-series analysis, Index numbers, Correlation, and Sampling. Again breaking down the most detailed section, Time series analysis, we find that provision is made for Trends, Seasonal variation, Cyclical variation, Incidental influences, Fourier and periodogram analysis, Method of variate differences, and Theory of smoothing and moving averages. Returning to the second of the two divisions of the statistical method which we selected as fairly representing the classification, we have the six subdivisions of Graphic representation: Scales, Time series, Correlation diagrams, Frequency charts, Area and map charts, and other graphic devices, as bars, blocks, pies, etc.

The key-terms of the statistical schedules, such as frequency charts, sampling, curve fitting, etc., are well brought out in the index to the classification. We do note three omissions: (1) Population growth; (2) Consumption requirements (that is, these headings in the index give no reference to our class number DDBJ, a part of the outline for the statistical method); (3) Tables (statistical). No doubt the index was made on the principle of guiding one to the subject itself rather than to methods of analyzing that subject.

The fact that the Harvard Business Classification is based on an actual book and pamphlet collection (that of the Baker Library) gives point to our next consideration. This is to discover, through the classification and its index, what treatment has been given to the statistics of particular subjects; i.e., under what subjects it was found necessary to make specific provision for statistical material.

We find statistical material provided for (in index or text) under a number of subjects which we may call roughly "utilities." Beginning with public utilities as a whole (VDD), we find waterworks (RUC), transportation (VJS), motor transportation (VOP), street railways (VSJ), railroads (WAO), pipe line transportation (WHD), railroad traffic management (WDMH), air transportation (WKN), water transportation (WNO), inland water transportation (WQE), port and terminal facilities (WQT), express companies (WWF), postal service accounting (WXF), communications industries (YAH), telegraph and cable (YBH), telephone industry (YCK), radio communications (YEW), electric light and power industry (YJL), district steam heating (YNF), gas industry (YPJ), and water supply (YRK). In each case the heading, or class grouping, is commensurate with headings like history, theory, organization, etc.

Another group, treated in much the same manner, we may term "construction industries." These are construction (RND), bridge construction (RQD), shipbuilding (RSD), waterway improvement (RTD), highways (VNE).

In the marketing group, we find marketing in general (SBJ), wholesale marketing of institutions (STE. "Not sales. For sales see FS"[1]), retail selling (SVC. "For statistics of sales see FS"[1]); storage warehouses (SUE), foreign trade, exports, imports, commodities (TE and TF).

The types of statistical information to be found in the Federal census volumes are provided for under population (EP. "Enumeration. For general works see CB"[2]). The word statistics is not used in the text in each case, but the index shows us that vital statistics, and statistics of age, sex, social condition (domicile, family, occupation, property), race and nationality, migration (immigration and emigration), wealth, and income, are meant to be placed within the EP group. With this group of the "social" statistics should also be mentioned LDNE—statistics of old age insurance and superannuation.

There remains a list of headings under which business statistics are provided for. We find these under the large class F: Business and economic conditions, surveys, and forecasts. Again, the word statistics is in most cases mentioned in the index only. We have statistical yearbooks and Government annuals (FA), individual business enterprises (FC), production (FP), sales and consumption of goods (FS).

Under KBFU, we find statistical reporting of Federal Reserve banks; under MF, statistics of land and land economics; under MTJ, real estate statistics; under RAE, manufacturing statistics, and under RYFS, the statistics of governmental services.

In addition to all this specific provision for statistics under subjects, we find in a general material-form list, a form subdivision for statistics (.04), which may be used wherever needed, at the discretion of the classifier.

From this examination it would seem that both statistics as a subject, and statistical data as a type of material, have been well provided for in the Harvard Business Classification, with respect to inclusion of all important items. The indices, the cross references and the frequent annotations are all features which assist the classifier in placing material correctly, and which make more clear the philosophy of relationships on which this scheme is based. The plan will also be helpful to some as a guide to business subjects. The possible adaptations of the various elements of the Harvard Business Classification carry its usefulness outside its particular subject field.

BEATRICE HAGER

New York Municipal Reference Library

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[1] Under: Business and economic conditions, surveys, and forecasts.

[2] Under: Sociology (demography).

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COMPARABILITY VERSUS CHANGE

BY VERGIL D. REED, *Assistant Director*
Bureau of the Census

EVEN THE role of recording angel must surely have its drawbacks. At any rate, the Census Bureau, as recorder of the nation's social and economic life, finds itself tossed about on an ocean of statistics by the fury of two uncompromising and opposing forces—comparability and change.

There are those who hold that "change breeds more mischief from its novelty than advantage from its utility." To them comparability must be the paragon of statistical virtues.

Opposed are those who feel that "In a higher world it is otherwise; but here below to live is to change, and to be perfect is to have changed often." To them change is needful even though painful; and inconvenience is the price of change whether it be from worse to better or better to worse.

Probably no subject is more discussed when statisticians or users of statistics get together than comparability of statistical series from one period to another as contrasted with the pressure for change in classifications or the inescapable changes which time dictates in the nature of the facts for which grouping is desired.

What is comparability? The dictionary defines it as "that which may be compared; fit to be compared." Perfect comparability of statistical data for any series over a period of time would represent the final achievement of a mathematical concept. It is socially fortunate, even though statistically regrettable, that perfect comparability in the field of population and economic activity over an extended period is seldom attainable. Perfect comparability is possible only in a static universe. In sharp contrast, change is the most typical of all characteristics in our social and economic order. The idea of a perfect vacuum wherein data are protected from the invigorating influences of changing realities is abhorrent to the real scientist whose main objective is to measure trends and changes—causes and effects.

It is the task of the Bureau of the Census to record actual existing conditions, not to determine what those conditions should be. This bureau has had a long, extensive, and intensive experience with the conflict between comparability and change. The decennial population censuses date from 1790. Manufacturing data have been collected since 1810. Censuses of Agriculture have been taken since 1840. The first census of distribution was taken for 1929. Current statistics have been gathered for many years. The two opposing forces are common to all of these fields, yet the resulting problems vary widely as to nature, urgency, and degree in each of them.

In the censuses and inquiries carried over a long period of years, the necessary changes made at each succeeding one are usually much less fundamental in extent and effect on comparability than in the case of the newer series. In this respect, our problem resembles that faced by the automotive industry. At first, design changes were radical, fundamental, and largely based on trial and error due to lack of a background of experience. Through the years these changes became less and less radical, more and more superficial, and were based upon sound experience and research.

In the case of those census series started more recently, such as the censuses of distribution and monthly data on industry and business, it is true that we had the results of general experience in census taking as a basis for their planning and execution. In spite of that fact, however, many new problems had to be faced. Pioneering was particularly necessary in classifications and proper grouping. The reactions of respondents differed from those found in other fields. The demands and needs of the respondent himself expressed through well organized groups had to be, and should be, met in so far as practicable. A different type of enumerator and a different type of field organization were necessary. Different office techniques had to be devised.

All the factors cited, and many others, had to be faced as realities and not as theories. They have necessitated radical and fundamental changes in the second and third of our distribution censuses which have played considerable havoc with comparability. This, in my opinion, is a normal healthy condition necessary in the early stages of any new series. The necessity for radical changes will decrease with succeeding censuses and, consequently, an increasing degree of comparability will be attained without unjustifiable and misleading "forcing" of the data.

Each census may be thought of as a photograph which depicts our industrial, economic, and social status at a given time. A succession of still pictures, if taken at sufficiently short intervals, constitutes a motion picture and shows dynamic actualities rather than an album of static photographs. Keeping this motion picture true to life is a major objective of Census officials.

The number of factors affecting comparability in data of a census type with national coverage in a wide variety of universes is surprisingly large. Some of these are subject to increasing control. Others can never be consistently and accurately controlled either from time to time or from place to place.

New social and economic conditions are constantly arising to dog the steps of those who, although they appreciate the need of as high a degree of comparability as possible, must record and classify these volatile actualities without bias and without "forcing" the facts into classifications that are outmoded or non-existent simply to attain an unreal and misleading comparability. Statistical comparability must be based on classifications *fit to compare.*

The rise of new industries and new products makes new classifications necessary and old ones useless. The automobile, airplane, radio, Diesel engine, plastics, air conditioning equipment, and rayon wrought many such changes. One type of distributor rises while another either disappears or becomes insignificant. Mattress walkers came and cordwainers went. Accounting practices vary from one period to another, from one place to another, and from one trade or industry to another. Such variations have an important bearing on the collection of business and industrial data and changes in them must be met.

Labor laws, social security laws, income tax laws, and the needs of new agencies, both private and governmental, force changes both as to the facts to be collected and the classifications into which they must be fitted. Large retail organizations expand their operations into new fields. New stores and entire chains are acquired. They acquire factories and enter the field of wholesaling. The same organization acquires grocery stores, meat markets, combination stores, and bakeries. Former chains become voluntary cooperative groups of "independent" stores. Chicken "factories" compete with the poultry farmer and are moving into cities—even to hotel roofs where the present scope of censuses of agriculture cannot include them. Part-time farming by the former city dweller has become a great factor. Trailers complicate our population census problems. The depression has caused many fundamental shifts and changes which will not even be known until discovered and measured in the 1940 census.

Field operations and technique must vary to meet specific conditions. In spite of desire on the part of Census officials, different dates within the calendar year may be designated from time to time for the taking of any given census. Better qualified enumerators are available in a depression period than in a period of prosperity. The period of training for supervisors and enumerators may vary from one census to another. "Split-establishments" (integrated organizations operating in several fields) are hard to break down on a strictly comparable basis at each census.

Variations in office methods and personnel are bound to affect the comparability of census statistics in spite of written editing and coding instructions, manuals of procedure and class instruction. The trouble begins even with the determination of the exact scope of the census or inquiry. Shall this border-line item be included or excluded? Shall manufacturers producing less than $5,000 volume per year be enumerated? Shall subscription agencies for magazines be included with retailers? Should those having no fixed or recognized place of business be enumerated? Why not exclude any so-called wholesaler who does less than $1,000 annual volume? Where do small bakeries belong—retail or manufacturing?

Definitions must necessarily vary and in spite of every safeguard they will, at least in some cases, be wrongly interpreted or misunderstood. If these definitions are vague, leave room for misunderstanding, or are open to multiple interpretations, the coders and officials to whom border-line cases are referred will find difficulty in determining what items should be included in and what excluded from a given classification. This difficulty results in shifts of a given establishment or individual from one class to another in different censuses. Hence, the definitions must at the same time be as accurate as possible and must not vary to any considerable degree from one period to another. Differences in the amount of detail given on the schedule at each census may also tend to cause similar shifts. Both definitions and classifications adequate today may be entirely inadequate ten years from today.

From the foregoing statements it is evident that the possible factors affecting comparability include variations in; (1) The social and economic structure itself; (2) quality of reporting; (3) editing; (4) coding; (5) tabulating; (6) analyzing; (7) definition of terms and classes; (8) the census date; (9) scope of census; and (10) units of measurement. The presence of these and similar conditions make comparisons over long periods extremely difficult, and at times dangerously misleading unless interpretation includes a knowledge of these limitations and their effects.

Specific examples drawn from various census divisions will aid greatly in acquainting the reader with the exact nature and extent of the problem of reconciling comparability and change.

The Census of Business, one of the new censuses previously mentioned, has been taken only three times. It is frankly admitted that the major emphasis has been placed upon getting the most complete coverage possible at each census with the available funds, time, and personnel. Comparability between censuses has suffered somewhat because of this emphasis. It is believed that the 1935 Census is complete enough in scope and coverage to be used as a base for future censuses. It is thought that most of the necessary changes in classification can be made without destroying comparability and with the extent of such changes known and pointed out clearly in future reports. A complete card index of retail establishments providing for the entry and comparison of major items for five censuses will permit ready checking of identical concerns and assist greatly in preventing unwarranted shifts from one classification to another, except in the case of new concerns established since 1935.

There was little precedent to guide in the collecting and presenting of business data in 1929, except the 120 years of experience gained in the Census of Manufactures. This experience failed to solve the problems of classification, however. This problem in classification may be appreciated from the fact that there were 343 minor and 24 major classifications for wholesale trade in 1929, 166 minor and 25 major in 1933, and 142 minor and 29 major in 1935. The large number of classifications and the shifts therein from census to census indicate the extent of change considered necessary. The same condition existed in retail trade.

These changes in classifications indicate that the Census of Business is going through a period of growth and development. The changes resulted from experience gained in previous censuses, from suggestions of business groups and statisticians, or from the exigencies of time and funds. Whatever their cause, they were made after carefully weighing their implications.

In addition to these conscious changes in plans, classification shifts have arisen from a number of other sources. Establishments were classified primarily on the basis of the information contained in the report submitted for a particular year, with no account being taken of the classification of that establishment in preceding years. The expansion of the census in 1933 to cover service establishments made it possible to draw more definitely the line of demarcation between retail stores and service establishments than in 1929. The increase in scope of the 1935 Census to include many other phases of our economic life also made for changes and refinements in classification.

In 1933 businesses were classified as service establishments only if their receipts from service exceeded two-thirds of their total receipts. It was felt that unless the determining percentage for receipts from merchandise sales was set at a low level during the depression, there was danger of confusing what were essentially retail stores with service establishments. Because of the conditions obtaining in 1933, merchandise sales dwindled to such an extent that revenue from service, ordinarily a subordinate function of the retail business, assumed unusual importance. In 1935 the retail-service border line was established at the 51 per cent mark.

Other shifts between classifications were also due to the fluctuations of the business cycle. In trying to determine, for example, whether a store was doing a wholesale or retail, service or retail, construction or retail, manufacturing or retail business, the line of separation was drawn on a 51 per cent basis for all three censuses; that is, if 51 per cent of an establishment's business was at retail, it would be classified in retail. Thus, establishments classified as wholesale in 1929 might have become retail stores in 1933 and 1935.

Shifts also occur within the retail census itself, as well as from retail to service or wholesale. This was particularly true of stores handling a combination of such things as furniture and hardware, groceries and feed, clothing and general merchandise, or coal and buidling materials. A change in the relative importance of one of the lines sold might be great enough even under "the 51 per cent rule" to change the classification in which the store belonged.

The 51 per cent test was not used in classifying drug stores because few so-called drug stores do most of their business in drugs. Many of them do not even have a pharmacist and prescription counter. If the proprietor or corporation returned the schedule as a drug store, it was so classified.

In the Census of Manufactures the "capital" inquiry appeared in the schedules from about 1849 to 1919 inclusive. This inquiry was crude, to say the least, yet it was retained under constant pressure from those who valued comparability.

At the Census of 1921, in order to reduce the cost of the work and facilitate the compilation of the statistics, those concerns showing value of products manufactured of less than $5,000 per year were excluded. This meant that the lower limit was raised from $500 to $5,000. What did this change mean in terms of comparability? The total number of establishments covered by the Census for 1921 was 250,266, of which 53,999 reported products at less than $5,000. These 53,999 establishments, although representing 21.6 per cent of the total number, contributed only six-tenths of 1 per cent of the total wage earners and three-tenths of 1 per cent of the total value of products.

Changes are constantly taking place within the industrial classifications of the Census of Manufactures. Comparability may be disturbed in some of the sub-classifications, but the main industrial group of which they are a part as a rule is not disrupted.

One of the most recent examples of classification change occurred in the Textile Products Group. At the recommendation of textile manufacturers, prior to taking the 1935 Census, those dyeing and finishing departments operated by cotton mills at the same location as the mills were included in a new classification called "Dyeing and Finishing, Cotton, Rayon and Silk." In former censuses, these departments of the cotton mills were treated as integral parts of the mill and, therefore, were included in the classifications "Cotton Goods" and "Cotton Smallwares." As a result of these changes the individual industries are not strictly comparable with former classifications, but the comparability of the textile group as a whole is not affected. The textile trade, however, feels that the *"improvement" in classification far outweighs the loss due to the lack of comparability.*

In the Census of Population, occupational classifications are an excellent example for our attention. To keep these classifications realistic, it has been necessary to make many changes in them to conform to the rapid and extensive occupational changes which even the last few decades have brought about. Under such conditions the Census classification of occupations cannot assume the unchanging character of a map grid or fixed framework.

Most population reports are made by the housewife. The occupational designations or descriptions given are neither scientifically accurate nor technically exact. They are given in popular terms common to the community of the respondent. In converting the returns into statistics the classifications bear the unmistakable mark of this popular terminology which changes with the times. Even the occupational indexes used for coding purposes must be made up largely from terms reported at preceding censuses. The occupational terminology of the people cannot be standardized any more than language and industry can be standardized. Occupations disappear or their names or meaning change. Old terms become obsolete. New terms must be added.

In spite of all these difficulties, there is real need for greater comparability between occupational statistics both as to time and as to those collected and compiled by different agencies. Any improvement in terminology would be a real contribution.

Vital statistics must be predominantly current in nature rather than of the census type as that term is generally understood. On the other hand, such statistics assume an international importance not common to most other statistical compilations. These data are collected largely through local medical officers, vital statisticians, and registrars. All these differences justify the citation of vital statistics as a field in which even international comparability is highly desirable but comparability by counties and states has not yet been attained due to the many difficulties faced.

It is commonly assumed that the problem of securing comparable mortality statistics will be solved if satisfactory readjustments can be made in the International List of Causes of Death. It is true that adjustments are essential in order to modernize the List to bring it into alignment with advances in medicine. However, other factors are involved in the production of statistical comparability of tabulations based upon the rubrics of the List. Among these factors are such items as: (1) The necessity of keeping comparability over time periods during which the List is being changed; (2) adjustment to the constant growth and change in terminology essential to changes in medical practice; (3) corrections for inaccuracies in the original notations on cause of death as written by the physician; and (4) the need for a consistent methodology in the selection of the primary cause of death to be tabulated when several causes are noted on the certificate.

In the collection of fatal traffic accident statistics, two distinctly different viewpoints give rise to discrepancies. From the standpoint of traffic control, the primary necessity is to arrive at an understanding of the causes of such accidents, while for statistical comparisons, the primary problem is to obtain comparability between the statistics gathered from different areas. To be sure, there is considerable overlap in these two viewpoints. A traffic department not only wishes to arrive at the cause of the traffic accident, but is interested in comparing the real gains or losses made in its particular city with those of others, and the statistician, whose primary interest is in comparability, is also concerned with cause of accident.

Looking forward to geographical comparability and coordination, as well as purely statistical comparability, the Committee on Accident Statistics, of the American Public Health Association, recently made the following suggestions:

(1) That the Bureau of the Census canvass the States and ascertain their activities relative to collecting, tabulating, and publishing accident data.

(2) That the Bureau of the Census study existing supplementary accident reporting forms with the object of preparing a standard form.

(3) That a study of accidents by the Bureau of the Census, in addition to the collection and analysis of such supplementary schedules, be conducted as a series of sample inquiries over limited periods of time in cooperation with the several States; that such inquiries involve the use of field workers, State or Federal, and be conducted in a manner similar to epidemiological surveys.

(4) That the procedure on accident analysis by Registrars and the definition of accident terminology be surveyed under the direction of the Bureau of the Census and incorporated as a part of the Instruction Manual of the Director of Vital Statistics.

The agricultural statistics "size of farms" furnish an outstanding example of change versus comparability. Originally the farm size classes were based upon judgment and convenient numerical separation, without much consideration to the general land survey system in use in the United States, i.e., sections, quarter-sections, etc. As this land layout really results in the "size of farms" clustering around 20, 40, 60, 80, 120, 160, etc., the significance of the size of operations was very seriously affected by the use of the former size groups. To overcome this, a new group was devised upon the basis of the United States land system unit, but in such manner that the old figures could be tied in and compared. In the 1935 Census of Agriculture both new and old groups were shown.

The Farm Census furnishes another example involving population. Large numbers of farm operators, listed in the agricultural census as farmers, have other occupations ranging from laborers to bankers. Under the present method we have one series of figures for farmers from the agricultural census, but another from the population figures classifying those gainfully employed. Formerly this number was not sufficient to cause much difficulty, but owing to changing conditions and the need for more exact definition in the classifications necessitated by new laws, this discrepancy must be accounted for. To overcome the difficulty it is proposed in the new farm census schedule to carry a question on "other occupations" and arrange it so that this can be separated from the "farmer figures," thus harmonizing the two series. Further, to advance the separation and define the border-line material, a 200 page statistical study of part-time farming has just been prepared, as part-time farmers constitute a large portion of the "two occupations" group.

Of the many similar examples illustrating changing conditions which upset comparability, found in agricultural statistics, are types of farms, changes in price level affecting the lower range of farms under three acres with the valuation of products' limitation, the change of green manure crops to a cash crop basis illustrated by the soy bean, changes in dates affecting all livestock classes, changes in farming practice affecting crop acreage such as from inter-planted crops to solid acreage, succession crops, and land in orchards planted to cash crops.

The question is often asked of Census officials, "How do you decide on the changes to be made?" With but few exceptions they are made after thorough and careful consideration by several qualified individuals in conference. Only those changes which are of small consequence are made on the decision of a single individual. We have no question as to the necessity of maintaining comparability and no changes affecting it are lightly made.

A Census Advisory Committee, made up of six outstanding members of the American Statistical Association, meets regularly with our staff and we are guided much, both as to policy and practice, by its counsel. Most of the various divisions of the Census Bureau have their own standing committees drawn from the leaders of the particular field covered. These committees serve without pay but the quality of their work and the amount of time contributed are most helpful and most generous. Through these committees we not only seek technical advice but better and closer contact with groups which represent the respondents and users of the data after compilation.

The Central Statistical Board is consulted with reference to all schedules and inquiries and it is a major function of that organization to promote comparability of statistical series as well as to coordinate the government agencies.

Conferences with representatives of interested groups, both private and governmental, precede all censuses and all current inquiries. For instance, in planning the Census of Business, 1935, over a hundred business leaders came to our Philadelphia headquarters for announced conferences. Many others were consulted individually as the need arose. These conferences contributed much toward proper schedules; toward securing the maximum of useful data with the minimum of inconvenience to respondents; and toward proper classification of the data to assure maximum usefulness.

As to the methods of minimizing changes and maximizing comparability, a number of suggestions are listed below, with the idea of stimulating further thought. They are by no means presumed even to approximate a final solution to the problem. A few of these suggested methods of approach are:

(1) Test the wording of schedules, the instructions to enumerators, and the office methods used in handling new classifications before adopting them, so that a bridge from the old to the new can be constructed.

(2) Have card records, schedules, and tabulations worked out in such a way that regrouping can be made according to both the old and the new classifications.

(3) Do not abandon the old series until the new one is devised, tested, and of sufficient value to take the place of the old series. This is particularly important in current series.

(4) Avoid, as far as possible, classifications based upon judgment alone, particularly judgment of the enumerators.

(5) Avoid use of supervisors who are inclined to use their own judgment instead of instructions.

(6) Avoid, as far as possible, classifications based upon a fixed point, for example a fixed percentage, when the nature of the series is such that it shifts back and forth.

(7) Arrange to have twilight zone material tabulated separately, so that it can be shifted from one classification to another if desired.

(8) Wherever possible, avoid changes in the date to which the statistics apply. If date changes are necessary, provide some means of measuring the significance of those changes.

(9) Check related series, as far as possible, and tie the work of one field in with that of another where necessary to give a complete picture.

(10) Assay the value of questionable series by leaving them out of the publication, and informing the public that they may be had by writing for them.

(11) Periodic enumerations, like photographs, are a cross section of time. A number of these enumerations placed together form a moving picture. In order to get the flow of the series to correspond with actual conditions, it may be necessary to apply the technique of the animated cartoonist or continuity man; that is, smooth the curve.

(12) Series which are expected to be used over a long period of time should be revised periodically. The International List of Causes of Death, for example, is revised every ten years.

In attempting to solve the problems of comparability versus change, or any other census problems, we invite your constructive criticism and welcome your assistance. Well conceived independent studies, aimed toward minimizing changes destructive to census comparability or maximizing comparability without stifling improvement, would be a welcome contribution to our national statistics. We feel that these problems are yours as well as ours.

THE WHOLE DUTY OF THE STATISTICAL FORECASTER

By Robert W. Burgess
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Professor Pearl's article in the December 1936 Journal regarding the work and personality of Karl Pearson calls attention once more to the important and fundamental contributions to statistical methodology made by that great scientist. The very excellence of this presentation, however, combined with the prominence in statistical literature of the mathematical methods originated and developed by Pearson, R. A. Fisher, and others, may throw somewhat out of focus the general picture of statistical analysis in all its phases as it is and should be used by economists, educators, business statisticians, and others. Unless supplemented by presentation of other points of view, such emphasis on mathematical methods of a particular type may even tend to divert effort from the channels which it is most advantageous to develop at the present stage of statistical growth in this country. Moreover, when these mathematical methods are carried over from the field of biology, where controlled experiment is usually practicable, into the field of social sciences, especially economics and business administration, there may not always be full appreciation of all the modifications of method and the supplementary methods which are necessary to secure helpful results.

In the following paragraphs, therefore, an attempt has been made to discuss in a broad way the functions of the less fully advertised phases of statistical work, with special reference to the point of view of statistical forecasting. It is urged that painstaking and intelligent handling of all these phases, even though some of it may be scorned as "low brow" by those who rejoice in elaborate machinery, is essential to reliable statistical conclusions. It is realized that some of this discussion may reflect unduly the particular experience and observations of the writer, even though the attempt has been made to test all statements by application to problems arising in a number of fields and under various conditions. Even though amendment and supplement may be necessary, however, it still seems worth while to present a point of view regarding the whole duty of the statistical forecaster.

The fundamental gospel of statistics is to push back the domain of ignorance, prejudice, rule-of-thumb, arbitrary or premature decisions, tradition, and dogmatism and to increase the domain in which decisions are made and principles are formulated on the basis of analyzed quantitative facts. Ideally, we may hope to let in the full light of day to illuminate what has been dark, but practical limitations often compel progress by inches, and by substituting for some completely unknown element, something that is still only partly known. From the point of view of the business statistician, progress is being made as long as the final state is less dark than the first.

In order to make progress in this sense, it is necessary to do many things in addition to developing the principles of mathematical statistics and statistical probability. It is recognized that many of these things were, in fact, done and are still being done by statisticians distinguished for their mathematical contributions, but they have not always been emphasized in accounts of their achievements. In compact phraseology, some of the things that the statistician must do, in these other phases of his work, are: Grub—Grind—Graph—and Guess.

GRUB

The good statistician, or if he is lucky, his good assistants, must go beneath the surface of published statistics, of proposed classifications and even of proposed problems stated to him by specialists in other fields, and find whether everything really is as it seems. Investigation often shows that the same definition of terms has not been used consistently throughout and off-line cases must be adjusted before the results can be used with confidence. Again, terms may have been used in a specialized sense clear to the first user or compiler but not carrying the same meaning to the prospective user in other fields. For instance, for some basic commodities, the accepted series for quantities delivered to fabricators are labeled "consumption" series even though they fail to reflect quantities actually entering the fabricating process because of variation in stocks kept on hand.

Again, it may develop after a little discussion when a problem is put up to the statistician, that the real difficulty is not what it is stated to be. For instance, the statistician may be asked to explain the construction of the cost of living index number and to work out the changes in the different components in a certain period, when what is really needed is information which will help a wage-earner to adapt his living standards to his income. The business statistician needs a general familiarity with the work of his colleagues and a willingness to go into their problems far enough to find where statistical methods will really help.

A good example of grubbing is the study summarized by Mr. George

A. Eddy in the May 1937 issue of the *Review of Economic Statistics* under the title "Security Issues and Real Investment in 1929." By a reexamination of each security issue, Mr. Eddy shows that the generally accepted figure for new security issues in 1929 was in fact about four times what it should be. Many other examples of grubbing could be cited by government statisticians, whose work calls for much straightening out of actual or potential difficulties of this general type.

It may be noted that the results of grubbing are often negative in that they show that published material does not mean quite what the uninformed think it means and therefore is not conclusive when used to support certain broad conclusions. The justification for grubbing is that it is better to know about such limitations on the data than to act with unjustified confidence on the basis of a faulty interpretation.

It is not intended to imply that the grubbing statistician does or should ignore the flowers that should ultimately spring from the roots near which he is boring. On the contrary, there are so many possible ways of refining crude data that he must have an eye on results in order to concentrate on those refinements which promise to be significant.

GRIND

Even after the fundamental data have been examined at the roots by the grubbing process, and basic mathematical methods have been determined, sound statistical work requires a great deal of "turning the crank," that is to say, carrying through of indicated computations. In the field of construction of desirable tables to facilitate statistical computations, the work of the school of Karl Pearson has been outstanding. Another group really embraced within the statistical field which has not hesitated at elaborate computations is that made up of the actuaries and their allies. Here and there through the statistical field, to be sure, there have been formulas developed with the sole object of by-passing required computations, even at a significant loss in accuracy, such as Sheppard's corrections and certain approximate methods in correlation. On the whole, however, statisticians of all types have been willing to grind and have done so as far as resources permitted. Sometimes the people who hold the purse strings, however, have not seen the necessity for the associated expense and have professed themselves satisfied with the fairly reliable estimates which a trained statistician experienced in a particular field can produce. For sound statistical work, the luxury of the off-hand estimate can be afforded only when it springs from a background of analysis of similar problems.

GRAPH

By this word it is intended to cover the whole process of bringing statistical results to a head and interpreting their meaning. Graphing in this broad sense requires an appreciation of the point of view of the people who have to use the statistics, such as business executives, Government and educational administrators and the investor. Business executives, for instance, have to make decisions and accept responsibilities regarding problems concerning which they cannot possibly be masters of all the legal, political, statistical, technical psychological, and scientific questions involved. The duty of the statistician in a business organization or in the social organization is to bring out clearly the main conclusions of his statistical analysis, together with the limitations of the data and his view of the application of the conclusions to the major problem. To the extent that this is done efficiently, final decision of the responsible executive is facilitated. It is often true that graphical representation is of great assistance in bringing out main conclusions, in a form that can be easily remembered and coordinated with non-statistical factors. Such graphing or other explaining will often seem like a waste of time and effort when viewed in detail, but since it is a key function in making statistics a guide to action, it is really of major importance.

GUESS

Even after the statistical forecaster has faithfully grubbed, ground and graphed to the best of his ability, resources and available time and energy, there will remain many aspects of almost any problem which have not been completely and scientifically analyzed. In particular, if the problem involves future contingencies, there will always be elements that are in the lap of the gods. It is therefore an essential phase of the work of the statistical forecaster to "guess," that is to say, to supplement the facts of record and his analysis thereof by the best possible conjectures regarding other factors. It is not intended to suggest that the statistician should ever make a completely arbitrary selection among the possible answers to doubtful questions, but that it may be necessary and desirable to select on the basis of very inadequate information rather than to omit a factor altogether.

In view of the strong hold, especially on the academic mind, of the desire for perfect proofs, it may be well to elaborate a little on this thesis. It has been said that you can solve a problem by computation or you can guess the solution, but you should never mix the two processes. The present thesis is that in almost any important problem involving forecasting, the actual process of thought used in helpful solutions necessarily includes both computing and guessing (or if you prefer, judgment and consideration of intangible factors). To bring out the point, let us briefly consider the processes of thought involved in two important problems:

1. Purchase of Stocks

The statistician who is selecting a stock for investment or speculative purposes utilizes, of course, all the published information regarding the earnings, assets, sales, and other factual records regarding the company concerned. He finds, however, much less in print about the public attitude toward the commodity or service which the company provides and about developments which may lead to a change in that attitude. And he will find almost nothing at all, except perhaps unsubstantiated generalities, about the efficiency and integrity of the management, the morale of the organization and the methods it is employing to assure a continuous stream of capable leaders in future years. It may well be, therefore, that an accidentally dropped remark revealing something about the character of the management may be a more important element in his final judgment than the entire registration statement.

2. Forecasting General Business Conditions

Any reasonable attempt to forecast business conditions a year or two ahead must pay some attention to probable political changes. If the consideration of this factor is based merely on published information and personal contacts appraised with an unprejudiced eye, the forecast will tend to be more accurate than if this factor were ignored. The forecast will be still sounder scientifically, of course, if a survey of public attitude is made and analyzed by the use of sound sampling procedures. The point is that the political factor should be considered by the methods which are most appropriate for the consideration of that factor, even though they are not as accurate or as satisfactory as the methods which can be used in connection with the analysis of the recent trends of production, prices, purchasing power, etc.

In general, when the statistician surveys any problem, he is likely to find that some aspects can be covered very adequately from the statistical point of view, others can be taken care of sketchily, while others can hardly be touched. From the point of view of the practical statistical forecaster, any further effort which can be made should be concentrated on the points where additional light would have the greatest effect on one's balanced judgment as to the proper action to be taken.

The general point of view as to the importance of guessing, judgment or weighing of intangible factors, may be enforced by consideration of the elements of any statistical problem which actually require this procedure.

1. Determination of Units

In the first place, the very determination of the units of measurement and the application of these units under varying circumstances often require considerable exercise of judgment. For example, when is a person to be counted as unemployed; how shall causes of death be classified; when shall a baseball player be credited with a hit, or when shall the opposing fielder be debited with an error?

2. Interpretation of Existing Series

Many standard derived series do not have exactly the meaning which the uninitiated think and it becomes a matter of statistical judgment whether the series can properly be used in the given problem. For instance, the Bureau of Labor Statistics Index of Wholesale Commodity Prices does not, in fact, cover highly fabricated commodities as satisfactorily as others, although it does attempt to include them to some extent and thereby differs from certain other wholesale commodity price indexes. It is obvious that this index does not constitute a guide as to the proper trend of prices of a highly fabricated piece of machinery nor is it comparable with the price trend for a basic agricultural product or mineral. The applicability in any particular problem must be decided on the basis of all the circumstances, some of which may not be completely measured. As another example, the Index of Manufacturing Production prepared by the Federal Reserve Board is necessarily built up by the use of those series expressed in physical units which are available over a considerable number of years. To the extent that manufacturing production is not fully represented by such series, the index is unsatisfactory for comparisons, especially those involving a long term.

3. Likelihood of Change

The psychological attitude or physical conditions back of most statistical ratios or other measures are changing from year to year or even from day to day. For instance, consider the background of such typical statistical measures as average age at retirement, birth rate, production per acre, correlation of price and supply, annual demand for shoes per capita, and the like. In terms of the theory of probability, these statistical measures are based on drawings from an urn which contains white and black balls in proportions which vary irregularly from time to time. It is the function of a statistician to apply these measures in future forecasts only after the broadest and most accurate practicable consideration of all the indications that may be available of how the composition of the urn has been changed.

4. *Inadequacies of Record*

Because of the pocket-book interest, political attitudes or personal reticence of those concerned, the printed record often cannot cover all the factors of a given problem. Other factors must be inferred from hints, inside information, or even hunches.

The argument in favor of considering intangibles before reaching a final recommendation based on statistical analysis does not justify relaxing one's attitude of caution and freedom from bias. The fact that an executive says that in the future, company policy will be so and so, should be considered in connection with the past record to see how far similar declarations of general policy have been reflected in actual results. The personal preference that we have for an upturn in the business cycle is an intangible that has no place in statistical forecasting, but is only too likely to creep in indirectly in the way facts are selected or statistics rounded off. It would, admittedly, avoid grave dangers of prejudice and bias to "consider no evidence not supported by analyzed facts," but the complete omission of all factors which cannot be so supported would often widen the difference between forecast and outcome.

In conclusion, the aim of this note has been to call attention to the important functions of grubbing, grinding, graphing and guessing in statistical work, especially statistical forecasting. It is recognized that there are other important things for the statistician to do—know the fundamental mathematical technique, acquire an encyclopedic knowledge of all published material in statistical method and in the fields related to his specialties, and cultivate contacts with colleagues and other statisticians. These other things have already been emphasized by other writers and by general acceptance in academic circles. This note will be well justified it if redresses the balance a little in favor of statistical functions which are often ranked lower in hierarchical standing.

CONSTRUCTION COSTS AND REAL PROPERTY VALUES*

By Frank R. Garfield, *Board of Governors of the Federal Reserve System, and* William M. Hoad, *Central Statistical Board*

Many people in private positions and in government agencies need accurate information about the level and the course of construction costs and real property values in order to work out satisfactory long-time policies and to plan day-to-day operations. Those most directly concerned are construction contractors, architects, buyers and sellers of real estate, lending institutions, public utility commissions, government building officials, and planning and taxing agencies. Economists and business analysts generally recognize the great importance of fluctuations in construction activity in general business movements and have a special interest in construction costs as they affect activity.

Few people, however, have recognized fully the need for careful analysis in this field and most of those who have tried to work out answers to pressing problems have not had sufficient information at hand. Frequently they have used available cost indexes to serve purposes for which they were not suited. Sometimes they have constructed new indexes by methods which the Supreme Court characterized as "dubious and obscure."[1] In general, analysts in this field, as in many others, have sought quick answers to problems without scrutinizing the data carefully and have hardly considered the possibility of working out a long-time program for the provision of more adequate information. Changes in property values—costs from the standpoint of the purchaser— have been recognized as extremely difficult to measure and, except for annual reports on farm land values, few current data have been generally available. The course of rents is often used to indicate the course of property values but at times this leads to incorrect conclusions, partly on account of inadequacies in rent figures and partly on account of differences in the amount and timing of movements in rents and in values.[2]

Recently some progress has been made both in providing additional cost data and in improving the analyses of existing information. Attention has been called to some of the inadequacies of existing series and to some of the advantages of compiling separate series to take account of differences by type of construction and by locality.[3] Also, some of the indexes now being published are based on bid prices or on actual costs per unit of completed work and are more satisfactory for the types of construction covered than the labor-materials cost indexes.[4]

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* Revision of a paper presented at the Ninety-eighth Annual Meeting of the American Statistical Association, Chicago, December 28, 1936.

[1] West et al v. Chesapeake and Potomac Telephone Co. of Baltimore City, 295 U. S. 662

[2] See Homer Hoyt, *One Hundred Years of Land Values in Chicago*, for analysis of differences in timing.

This paper has been prepared primarily to emphasize the significance of certain distinctions which analysts in this whole field often overlook and to suggest possible methods of improving current information, particularly with respect to the cost of houses.

ORIGINAL COST OF PROPERTY AND ANNUAL COST OF OWNERSHIP

Again and again in discussions of changes in costs and rents and their effect on the volume of residential building, no distinction is made between original cost, a capital sum, and the annual cost of ownership, an amount per year. Actually, however, prospective buyers are interested in the annual costs incidental to ownership and these depend not only on original cost but also on other factors, such as interest rates and tax rates, which fluctuate in their own fashion.

In calculating the annual cost of ownership buyers do not use any uniform method and often fail to take adequate account of such items as repairs and special assessments, but they do know the amount of the down payment and of the current payments on any mortgages and consider some other items, such as taxes and insurance. Annual cost is sometimes thought of on an outlay basis, sometimes on an accrual basis. Outlays, including repayment of loans, are important because they represent a burden on the buyer's income, and failure to meet obligations may mean loss of the property. Estimates of costs on an accrual basis, including anticipated depreciation or appreciation on the property, permit the buyer to compare the cost of renting and owning more closely and to figure the return on his investment.

Rates of interest, taxes, and the like enter into annual costs and do not fluctuate closely from year to year with original cost. During the winter of 1936–1937, for example, interest rates on mortgages were declining, while the cost of labor and materials, the price of land, and the size of the contractor's margin, which together make up most of the original cost of new property to the purchaser, were rising.

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[3] See especially Corrington Gill, "Construction Statistics," this JOURNAL, March 1933; James S. Taylor, "Construction Cost Statistics," Proceedings Supplement, this JOURNAL, March 1934; Lowell J. Chawner, "Construction Cost Indexes as Influenced by Technological Change and Other Factors," this JOURNAL, September 1935.

[4] See, for example, *Public Roads*, Vol. 14, pp. 81–92, and reports by the Bureau of Valuation of the Interstate Commerce Commission.

This major distinction between original and annual costs has been recognized in some analyses of building conditions, but it is stressed here because it is so often disregarded. Perhaps some day additional information may be available indicating more clearly the course of both original and annual costs to the purchaser, and making possible more meaningful discussion about the course of costs, rents, values, and the volume of residential building.

ORIGINAL COST

Considering original cost only, there are a large number of distinctions that make a real difference in analyzing events. Certain of these distinctions are discussed in some detail below, with some data to suggest how much difference they make. Various other distinctions have been kept in mind but their importance is not discussed here. Nothing is said, for example, about the relative cost of public and private construction; about costs of prefabricated houses; about cost differences between large scale developments, involving the erection of many houses of similar design by a single operative builder and the construction of custom-made houses to individual design; or about variations in the cost of construction as between different contractors doing the same type of work in the same locality.

The distinctions discussed below relate to newly-built and old structures; the type, size, and material of structures; the locality; and the cost of labor and materials as compared with the total costs to the contractor and with the cost of the whole property, including land and the contractor's margin, to the purchaser. The analysis of the cost to the purchaser is based largely on a special tabulation of data from the Financial Survey of Urban Housing so far as it relates to one-family houses.[5]

Newly-Built Structures and Old Structures

Any adequate analysis of the cost of houses to purchasers must recognize the direct competition between new and old houses. At times such as the present, for example, when lending agencies hold considerable real estate which they wish to sell, prospective home-owners may find the price of houses already built lower than the cost of a comparable new house by an amount larger than in some other periods when fewer old properties are on the market and costs of building new are relatively lower. Prices of old houses may also vary considerably from what might be expected on the basis of rents. In general the differences in movements of prices for old and newly-built houses appear to warrant careful analysis, but this field has not been explored in this study.

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[5] This special tabulation was made through the assistance of the Federal Housing Administration and the cooperation of the Department of Commerce, which made available material collected in the Financial Survey of Urban Housing.

Type, Size, and Material of Structures

The importance of separate indexes for various types of construction, such as road building, factory construction, and residential building, has been demonstrated in such analyses as those by Taylor and Chawner and in such compilations as those made by the Bureau of Public Roads and the Interstate Commerce Commission. Series by type of structure are desirable not only because various items of cost differ in importance but also because technical changes proceed much more rapidly in some cases than in others. Road building in recent years has been an example of rapidly changing techniques. When techniques change rapidly an average bid cost or an average cost per completed unit of work is a more accurate measure than an index based on some of the principal labor and material items. In this study, concerned primarily with the one-family house, the general approach has been to analyze the course of average prices paid for the house and lot rather than to follow through the course of various costs that make up the total. This procedure was used partly because data were not available on many important items relating not only to matters of construction technique but also to such items as contractors' margins and land.

The data used are based on reports by owner-occupants at the beginning of 1934 as to the original cost of their properties, including land, in the year when the houses were built. Most of the reports were for wood houses, principally of 5 and 6 rooms. The first chart shows how many owners in Cleveland reported various original costs in 1924 for 5- and 6-room wood houses and for all types of one-family houses, except that 13 houses costing $28,000 have been omitted. The chart suggests at once that, while averages for all types of one-family houses might be useful for some purposes, a time series based on such averages might not be a satisfactory measure of price changes, because it might be influenced by changes in the proportion of high-priced and low-priced structures.

The two lower lines on the chart indicate that, by using reports on wood structures of a similar size, of which many are built on roughly similar plans and in similar local areas, a more homogeneous sample can be obtained. They also suggest that a time series based on averages

CHART I

COST OF NEW HOUSE AND LOT TO PURCHASER, CLEVELAND, 1924

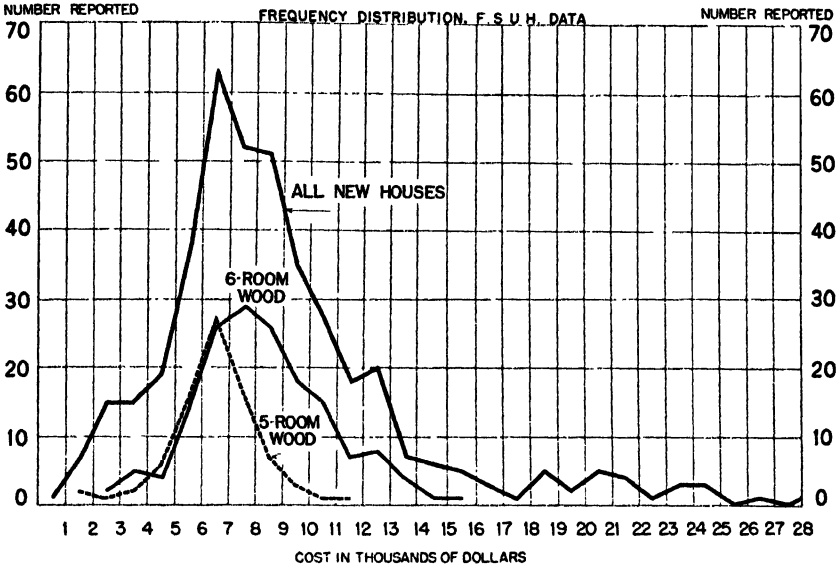
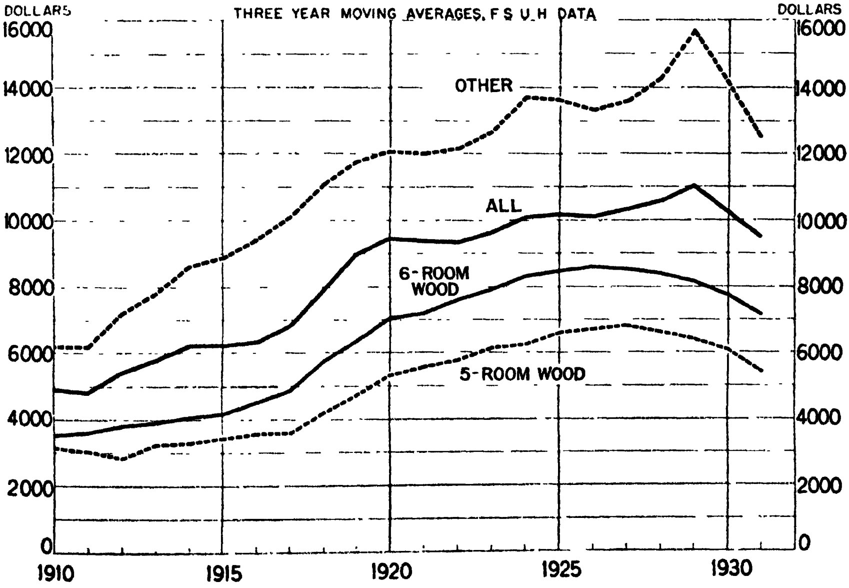


CHART II

COST OF NEW HOUSE AND LOT TO PURCHASER IN CLEVELAND



of these data might be more accurate for measuring price movements than a series based on all types. Of the 5-room wood houses, about one third cost between $5,000 and $6,000 and two thirds cost between $4,000 and $8,000 with the remainder evenly distributed below and above those classes.

The second chart shows such time series, on a three-year moving average basis, over a long period. The curves for 5-room and 6-room wood houses are believed to be much more satisfactory measures of price changes than the curve for all types of one-family structures. Comparisons, particularly over a long period, however, cannot be regarded as precise in view of possible differences in the accuracy of reporting and in view of changes in such items as the quality of construction and the size of rooms.

The way in which a change in the type of house built may affect average costs is indicated also in the following table showing building permit valuations for brick and frame 6-room houses built in Cleveland in the years 1929 to 1933.

PERMIT VALUATIONS

Averages for 6-room houses in Cleveland

	Brick and frame	Frame	Brick
1929	$5,410	$5,238	$6,930
1930	4,862	4,702	6,426
1931	4,487	4,200	5,314
1932	4,427	3,712	4,944
1933	4,438	3,665	4,761

Source: Bureau of Labor Statistics.

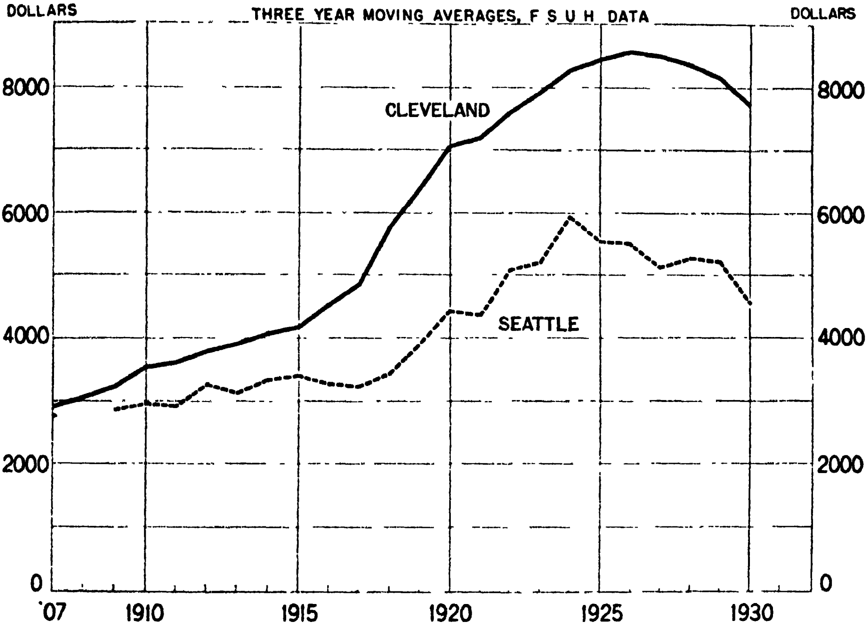
The decline shown for brick and frame structures from 1929 to 1933 was 18 per cent, while for frame structures alone it was 30 per cent and for brick structures alone 31 per cent. The difference reflected an increase during this period in the proportion of brick structures, which were considerably higher-priced than frame structures.

Locality

In different localities the average costs of houses show wide differences in level, reflecting such factors as differences in the type of construction, in wage rates, in prices of materials, which may be near at hand or distant, and in the price of land. There are also some differences in the amount and timing of changes, depending on many developments, including the rates of growth of communities, the timing of building booms, and shifts in sources of materials. The accompanying chart for 6-room wood houses shows the extent of these differences in cost as reported for Cleveland and Seattle; and charts based on 5-room wood houses and 4-room wood houses show similar results. Differences may occur between sections of a single city or metropolitan area as well as between cities of different location and size.

CHART III

COST OF NEW 6-ROOM WOOD HOUSE AND LOT TO PURCHASER, CLEVELAND AND SEATTLE



The current cost indexes published by the Home Loan Bank Board for a standard 6-room structure, not including land, show considerable differences in cost movements in particular cities during 1936 and 1937. They also indicate substantial differences in level as between different communities. The choice of one standard type of structure for the whole country, however, has the limitation that in some communities quotations are on the cost of a structure which is not typical of the houses actually constructed. Also, in this type of index, which has a constant percentage allowance for contractor's margin, no allowance is made for changes in that margin with changes in market conditions.

Costs to Contractor Versus Costs to Home-owner

One common procedure in analyzing the demand for new residential building is to plot an index of labor and material costs against an index of rents charged and to compare them directly. This procedure has the disadvantage of ignoring the distinction between annual costs and original costs, and that between rents and values. It also fails to take account of the differences between costs to contractors and costs to buyers and between labor and materials costs to the contractor and his total costs.[6] The difference between total costs to the contractor and prices paid by the buyer reflect various items, including the contractor's margin and land prices, which at times vary differently from costs incurred by contractors.

Rather meager annual data for 25 cities, compiled in the special tabulation of data from the Financial Survey of Urban Housing, showed that fluctuations in prices paid by buyers differed from those shown by the labor-materials cost indexes but did not yield conclusive results concerning the amount of the differences. The samples were small, and at times, such as 1920, a bias appeared, owing to the fact that many home-owners who paid the highest prices lost their properties and were not in the sample of home-owners reporting in 1934 as having bought and built their present homes in 1920. Prices paid by purchasers did not fluctuate closely with the prices of labor and materials in some years, but the evidence studied was really only sufficient to suggest the desirability of further studies and of collection and analysis of additional data in the future, both for labor, materials, and other costs to the contractor and for prices paid by buyers.

IMPROVEMENT OF COST STATISTICS

The need for improvement in cost statistics is pressing, as events in 1937 have indicated. The discussion in this paper has focused on original costs, particularly of newly-built houses, furnishing some clues for increasing our knowledge in this field. It is to be hoped that the problem of obtaining adequate information on original costs of both newly-built and old structures will be explored further and that interested agencies will also press forward investigations concerning interest rates and other rates which, together with original costs, determine annual costs of ownership.

Two general methods can be used to trace the course of original costs of newly-built structures. One is to estimate changes in the total from changes in various cost items; the other is to measure changes in the total directly.

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[6] For discussion of items of cost to contractor, see Corrington Gill, cited above.

The first method has the advantage of indicating changes in the relationships between the parts, as well as fluctuations in the total, thereby providing a basis for planning action with respect to specific costs. Are the available cost indexes, which are computed in this manner, satisfactory for these purposes? They have been based generally on the cost of labor and materials only, showing nothing concerning changes in other costs to the contractor, the price of land, or the size of the contractor's margin, all important items in the total original cost to the purchaser. Labor and materials costs have generally been measured by nominal wage rates and quoted materials prices rather than by actual rates and prices and adequate account has not been taken of changes in the efficiency of labor and in techniques.[7] The figures of the Federal Home Loan Bank Board, available since the beginning of 1936, represent a definite improvement over national all-purpose indexes in that they are based on reports from contractors as to actual prices and wage rates paid, in that the weighting of the various items has been designed to fit a particular structure, and in that they are local series; but changes shown by these data reflect only changes in wage rates and material prices. Without considering in detail the various statistical deficiencies of available indexes with regard to weighting and other matters, it appears on the basis of items covered and the actual behavior of the various series that such indexes are not adequate for analyzing cost movements and working out a balanced program of action dealing with all items of cost. Careful studies should be made, therefore, to develop more satisfactory series of this general nature and in the meantime interpretations of current developments should be based on consideration of more elements in the picture than those included in the available indexes of building costs.

The second method, that of obtaining reports concerning the total cost of property directly, might provide a means of gauging developments more accurately than available cost indexes because it would include all items that make up the original cost of the property, new or old, to the purchaser. The statistical problems involved are considerable, but the analysis here has indicated that this approach is a useful one. Changes in total costs of new houses can be measured by the use of averages based on relatively small samples, provided a fairly homogeneous unit, such as the 5-room wood house or the 6-room wood house, is used. Changes in such costs can be checked by comparison with series based on houses of different size. Costs in one city can be compared with those in neighboring cities, taking due account of differences in the size of city and other factors affecting costs. This method of analysis permits, within limits, the selection in any one locality of the types of structure which are most typical of that locality; cities where apartment construction predominates, however, would present a special problem. In small places and in periods of little building, the problem of obtaining sufficient data to develop a current series at short intervals would be serious. Just how large the sample would need to be in any particular locality could be determined only by further study and would depend in part on the character of the community, the nature of the basic data, and the intervals covered. An annual series for Cleveland, based on owner-occupant reports in 1934, covering 150 to 200 new 6-room wood houses each year during most of the 1920's, was not subject to erratic fluctuations and indicated changes corresponding quite closely with those shown by series for houses of other sizes.

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[7] For differences between union and nonunion wage rates, see "Wage Rates and Hours of Labor in the Building Trades," *Monthly Labor Review*, August, 1937, Bureau of Labor Statistics, United States Department of Labor. For changes in average hourly earnings, see current monthly reports of the Bureau of Labor Statistics.

With series based on reports of total cost, as with those based on reports on costs of the constituent parts, the problem of obtaining accurate basic data requires careful study. The historical data used in this analysis were collected from home-owners in a sample study at a single date and were subject to various limitations which would not apply to data collected currently. Nevertheless data of this sort provide an approximate historical record useful as a background in interpreting current developments. Local real property inventories could include questions designed to obtain such historical information for all existing properties without unduly increasing the expense. The reports, however, would need to be supplemented by current information.

Data collected by the Federal Housing Administration in the course of insuring mortgages on both old and new structures constitute another important source of information on original cost to the purchaser. The records show the year built, the year bought, the price paid, and many details concerning such items as type, material, and size. They also show some separate estimates of the value of land which might provide one useful breakdown of the total. These records might provide considerable historical data and furnish a basis for more detailed analysis of costs than was possible in this study. Moreover, they might prove highly useful in providing prompt reports on current changes in cost to the purchaser. The sample is restricted to properties insured by the Federal Housing Administration, which would be a more important limitation in some communities than in others.

One method of obtaining current information concerning original costs to the purchaser would be to use building permits issued and deeds recorded to obtain a record of new houses being built and old houses being transferred and then, after selecting the types of structure to be covered, to find out by inquiry the actual cost of the property to the buyer.

Two other sources of information may be useful in studying changes in the cost of new structures, but not of land, or of old structures. They are the prices specified in contracts and the valuations placed on structures in obtaining building permits. The F. W. Dodge figures on floor space and value of contracts might be examined in detailed fashion to see whether average cost per square foot by type, material, and size of structure, and by locality, would prove useful. Permit valuations might be analyzed closely to see how far changes in permit valuations reflect changes in costs and to develop series to measure changes in costs. Heretofore interpretations of contract and permit data on cost have been based largely on averages for a wide variety of structures. However useful such averages may be for some purposes, they are not satisfactory for measuring changes in cost because they are influenced by shifts in the proportion of buildings of various types, sizes, and materials. Recently the Bureau of Labor Statistics has made a special study of permit figures for 811 leading cities giving considerable detailed information including annual averages from 1929 to 1935 of valuation per dwelling unit and per room both by material and type of construction. For some of the cities cost per square foot or per cubic foot is also being computed.

Whatever data prove most useful, it appears that the first job is to obtain series satisfactory for particular localities. Such cost series could be used in interpreting local developments and also in obtaining some idea of cost changes by areas, by size of city, and for the country as a whole.

Pending the development of adequate cost statistics for residential building and also for other types of construction, people interested in current developments must rely on insufficient data, making such estimates as they can of both original and annual costs. And important policies will be based on those estimates!

THE PREPARATION OF CORRELATION TABLES ON A TABULATOR EQUIPPED WITH DIGIT SELECTION

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THE PRINTING OF THE TABLE. It is possible to use a tabulator equipped with digit selection for the purpose of printing the correlation table if one of the variables, say x, is a one place number or if the distribution for x has been coded into ten equally spaced class intervals. It is possible to obtain, at the same time, the sums of the frequencies by rows and, with an additional run through the tabulator by columns.

The following illustration was obtained by running 123 cards through the printing tabulator. The cards were sorted on the column for variable y and arranged in descending order. The machine was wired to distribute the frequencies for $x=0$, $x=1$, $x=2$, $x=3$, etc., into the columns labelled 0, 1, 2, 3, etc. The total frequency was recorded in the column labelled "Tot."

The method of wiring is described in the Appendix.

TABLE I

CORRELATION TABLE ON PRINTING TABULAR MACHINE SHEET*

y	*x*										*Tot.*	$C(x_v)$	$C(y_v)$
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*			
9				1	1	1	1				4	18	36
8												18	36
7				1			1				2	27	50
6	1	1	2	1							5	35	80
5	2	2	1	3	3	1	2	2	2	3	21	134	185
4	3	2	1	2	2	2	2	1	1	1	17	198	253
3		1	3	2	2	1	2	2	1		14	258	295
2	1		2	1	2	2	2	2	1	1	14	326	323
1	3	2	1	1		1	2	3	3	2	18	413	341
0	1	3	5	4	1	2	3	3	3	3	28	542	341
Tot.	11	11	15	16	11	10	15	13	11	10	123	542	341

* The items in italics and the rules are added to the machine sheet by hand.

The last two columns of Table I are explained later. The first row, containing columnar headings, was inserted after the table was run. The last row was obtained by running the cards through the machine with the minor control switch turned off.

A second illustration involves a variable y which has more than one digit. It is necessary to sort the cards for each digit of y so that the cards are arranged in descending order as indicated in Table II. The wiring, and the machine work are as before.

TABLE II

CORRELATION TABLE INVOLVING ONE TWO-DIGIT VARIABLE

y	x					Tot.	$C(x_y)$	$C(y_y)$
	0	1	2	3	4			
19	3	4	8	4	3	22	44	418
18	6	5	6	8	2	27	93	904
17	4	12	13	8	6	43	179	1635
16	5	3	8	10	10	36	268	2211
15	7	7	16	18	9	57	397	3066
14	7	15	28	14	10	74	550	4102
13	18	16	17	23	11	85	713	5207
12	15	22	30	25	15	107	930	6491
11	19	21	36	17	23	116	1166	7767
10	28	40	42	41	20	171	1493	9477
09	27	40	54	41	30	192	1884	11205
08	28	39	54	49	31	201	2302	12813
07	30	34	47	53	29	193	2705	14164
06	28	45	48	37	31	189	3081	15298
05	29	27	40	25	21	142	3347	16008
04	21	22	28	15	16	102	3534	16416
03	7	6	7	7	3	30	3587	16506
02	2	5	6	2	2	17	3618	16540
01		4		2	5	11	3648	16551
00	11	1		1	1	14	3656	16551
Tot.	295	368	488	400	278	1829	3656	16551

The first seven columns of Table II present the correlation table, with summaries by rows and columns, registered by 1,829 cards which had been punched with the two digit number, y, and the single digit number, x. In this case the value of x was at no time greater than 4 so it was only necessary to record $x=0$, $x=1$, $x=2$, $x=3$, $x=4$ and totals.

THE COMPUTATION OF MEANS, STANDARD DEVIATIONS, CORRELATIONS, AND SKEWNESSES

The last two columns of Table I and Table II give additional information which accelerates the computation of means, standard deviations, and correlation coefficients. These columns may be obtained simultaneously with the correlation table if a few wires are added and if the machine has sufficient capacity.

In Table I it is only necessary to wire column $5(x)$ of the add brushes to a counter and column $10(y)$ of the add brushes to another counter. These two counters should be set to take progressive totals. In order to insure the correct progressive repetition of each digit on column 10 it is necessary to insert blank cards where a digit is missing as is 8. In this way are recorded the values of $C(x_y)$ and $C(y_y)$ where x_y represents the sum of all the x's having a given value of y and y_y represents the sum of all the y's having a given value of y. Thus in Table I the x_y entry for $y=9$ is $1(3)+1(4)+1(5)+1(6)=18$ while the corresponding y_y entry is $(9)(4)=36$. $C(x_y)$ and $C(y_y)$ indicate that the values x_y and y_y are cumulated with the progressive totals feature of the machine.

The size of the totals, machine capacity, and available attachments determine how much of the running can be completed in one operation.

The last entries in the last three columns of Table I give respectively $\Sigma f=123$, $\Sigma x=542$, $\Sigma y=341$ from which $M_x=4.41$ and $M_y=2.77$ are readily obtained. The standard deviations and the correlation coefficient may be obtained by the use of an adaptation of the Mendenhall-Warren-Hollerith correlation technique.[1]

The values Σxy and Σy^2 are obtained from the formulas

$$\sum xy = \sum_{y=1}^{9} C(x_y) = 413 + 326 + \cdots + 18 = 1427$$

$$\sum y^2 = \sum_{y=1}^{9} C(y_y) = 341 + 323 + \cdots + 36 = 1599.$$

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[1] Warren, Richard and Mendenhall, Robert M. The "Mendenhall-Warren-Hollerith Correlation Method." Columbia University Statistical Bureau, Document No. 1. Columbia University, New York City, N.Y. 43 pp.

See also Warren, Richard and Mendenhall, Robert M. "Computing Statistical Coefficients from Punched Cards," *Journal of Educational Psychology* 21(1930), 53–62.

According to the Mendenhall-Warren-Hollerith correlation method, it is necessary to re-sort the cards for x and record $C(x_x)$ and, for checking purposes $C(y_x)$. Then

$$\Sigma x^2 = \Sigma C(x_x) \text{ and } \Sigma\, xy = \Sigma\, C(y_x)$$

It is possible however to get Σx^2 from Table I directly since

$$\Sigma x^2 = 11(1)^2 + 15(2)^2 + 16(3)^2 + \cdots + 10(9)^2 = 3332,$$

and since

$$\sigma_x = \frac{1}{n}[n\, \Sigma x^2 - (\Sigma x)^2]^{1/2}, \quad \sigma_y = \frac{1}{n}[n\, \Sigma y^2 - (\Sigma y)^2]^{1/2}$$

$$r_{xy} = \frac{n\, \Sigma xy - (\Sigma x)(\Sigma y)}{\{[n\, \Sigma x^2 - (\Sigma x^2]\ [n\, \Sigma y^2 - (\Sigma y)^2]\}^{1/2}}$$

we have

$$\sigma_x = 2.77, \ \sigma_y = 2.31 \text{ and } r_{xy} = -.096.$$

The corresponding computations could be made for Table II though the range of y would be from 1 to 19.

It is not the primary purpose of this paper to indicate various correlation techniques but rather to present the correlation chart. In so doing, however, we are able at the same time to obtain information which makes possible the determination of the correlation coefficient without additional tabulations. Other methods of obtaining Σx^2 and Σxy are the Mendenhall-Warren-Hollerith Correlation Method indicated above and the progressive digit method described by A. E. Brandt.[2]

It is shown in another paper[3] that

$$\sum y^3 = \sum_{y=1}^{9} C(y_y)(2y - 1)$$

so that in Table I

$$\Sigma y^3 = 341 + 3(323) + 5(295) + \cdots = 8903$$

while

$$\Sigma x^3 = 11(1)^3 + 15(2)^3 + 16(3)^3 + \cdots = 23138$$

and by the usual formulae we have

$$\mu_{3:x} = 1.13 \qquad \mu_{3:y} = 6.88$$

$$\alpha_{3:x} = .05 \qquad \alpha_{3:y} = .56$$

[2] Brandt, A. E. "Uses of the Progressive Digit Method." *Practical Applications of the Punched Card Method in Colleges and Universities.* pp. 423–436.

[3] Dwyer, Paul S. "The Computation of Moments with the Use of Cumulative Totals." Published in the current (December 1937) issue of the *Annals of Mathematical Statistics.*

CUMULATIVE FREQUENCIES AND STATISTICAL CONSTANTS DEPENDENT UPON THE POSITION IN THE FREQUENCY DISTRIBUTION

With the same wiring as above it is possible to use the cumulative feature of the tabulator and to obtain simultaneously the cumulative frequencies of *all* the columns of the correlation table. This technique is appropriate when medians, deciles, and other statistical quantities dependent on position, are needed. An illustration is given in the next section in Table V.

THE CASE IN WHICH THE VARIABLE X IS CATEGORICAL

The general methods outlined are applicable to the situation in which the variations in x represent qualitative, rather than quantitative, differences. It is of course necessary that these qualitative differences be coded and punched on the cards.

As an illustration, we use the 1,289 cards containing the records of freshmen students entering nine of the curricula of the University of Michigan in 1935. In Table III the first column represents the coded first semester academic record. The code number 0 represents .00 –.49 grade points, 1 represents .50 –.99 grade points, etc. The successive columns, coded 0 –8, represent students enrolled in Literature, Science and the Arts (General); Pre-medical; Pre-legal; Pre-dental; Pre-

TABLE III

MACHINE SHEET FOR CATEGORICAL VARIABLE

y	x									*Tot.*
	0 *LS&A*	*1* *PM*	*2* *PL*	*3* *PD*	*4* *PB*	*5* *E*	*6* *A*	*7* *P*	*8* *PE*	
8	5		4			2				11
7	17	9	8		3	16	1			54
6	69	17	24	1	9	37	7	1	2	167
5	77	21	39		19	74	6	4	1	241
4	165	38	40	3	56	81	17	4	8	412
3	65	25	23	1	28	44	6		6	198
2	49	22	17	2	15	27		3	2	137
1	11	11	3	1	13	10	1	1	2	53
0	4	2	7	1		2				16
	462	145	165	9	143	293	38	13	21	1289

business administration; Engineering; Architecture; Pharmacy; and Physical Education, respectively.

If the cumulative feature of the tabulator is used, the machine records the cumulative frequencies of the respective columns. From these distributions the values of the medians, deciles, etc. are easily obtained. The wiring is identical with that for Table III.

It should be noted that Table IV cumulates the frequencies from the highest grades and not from the lowest grades. Thus the entry, 168, in the LS&A column indicates that there are 168 students in that group who made 5, 6, 7, or 8 on the coded first semester record. The cumulative frequency distribution which cumulates from the lowest grades up could be obtained by arranging the cards, with reference to column y, in ascending order.

TABLE IV

CUMULATIVE TABULATION OF DATA IN TABLE III

	LS&A	*PM*	*PL*	*PD*	*PB*	*E*	*A*	*P*	*PE*	*Tot.*
8	5		4			2				11
7	22	9	12		3	18	1			65
6	91	26	36	1	12	55	8	1	2	232
5	168	47	75	1	31	129	14	5	3	473
4	333	85	115	4	87	210	31	9	11	885
3	398	110	138	5	115	254	37	9	17	1083
2	447	132	155	7	130	281	37	12	19	1220
1	458	143	158	8	143	291	38	13	21	1273
0	462	145	165	9	143	293	38	13	21	1289

The correlation coefficient is inapplicable to the case of categorical series but for summary purposes it is customary to compute the mean and standard deviation of each of the columns. With some changes in wiring and with no additional sorting it is possible to record a table from which these values are readily obtained. The machine is wired to give $C(x_y)$ instead of $C(f_y)$ for the different values of x. The wiring is changed by removing the Card Count wire and replacing it with the wire from add brush $10(y)$.

The results are recorded in Table V. The values opposite $y=0$ are also the values of Σy. If Table III had not been previously obtained the machine could be wired to give frequencies, (see last row of Table

III), and the results of the run recorded in the row labelled Σf. Σy^2 is obtained by adding the values above $y=0$. The two last rows are obtained from the usual formulae $M_y = \Sigma y/n$, $\sigma_y = [n\Sigma y^2 - (\Sigma y)^2]^{1/2}/n$.

TABLE V

TABULATION FOR COMPUTING MEANS AND STANDARD DEVIATIONS

y	x									
	LS&A	*PM*	*PL*	*PD*	*PB*	*E*	*A*	*P*	*PE*	*Tot.*
8	40		32			16				88
7	159	63	88		21	128	7			466
6	573	165	232	6	75	350	49	6	12	1468
5	958	270	427	6	170	720	79	26	17	2673
4	1618	422	587	18	394	1044	147	42	49	4321
3	1813	497	656	21	478	1176	165	42	67	4915
2	1911	541	690	25	508	1230	165	48	71	5189
1	1922	552	693	26	521	1240	166	49	73	5242
0(Σy)	1922	552	693	26	521	1240	166	49	73	5242
Σf	462	145	165	9	143	293	38	13	21	1289
Σy^2	*8994*	*2510*	*3405*	*102*	*2167*	*5904*	*778*	*213*	*289*	*24362*
M_y	*4.16*	*3.81*	*4.20*	*2.89*	*3.64*	*4.23*	*4.37*	*3.77*	*3.48*	*4.07*
σ_y	*1.47*	*1.67*	*1.73*	*1.73*	*1.38*	*1.50*	*1.17*	*1.47*	*1.29*	*1.53*

APPLICATION TO MULTIPLE PUNCHED COLUMNS

The method can be used similarly when multiple punches occur in the x columns. The code for column 5 of the 1,289 cards is:

0	Sex	Male
1		Female
2	Residence	Michigan
3		Outside Michigan
4	Preparatory School	Public
5		Private
6	Action at Entrance	Probation Only
7		Deficiency Only
8		Probation and Deficiency

The frequencies of these groups, for different first semester grades, are presented in Table VI. It is to be noticed that the "totals" column is composed of the first two groups, (0, 1), the next two groups, (2, 3), the next two groups, (4, 5), but *not* the last three groups since only a small proportion of the students were admitted to college on probation or with deficiencies in credits.

TABLE VI

TABULATION INVOLVING MULTIPLE PUNCHING

	Sex		*Residence*		*Prep. School*		*Action at entrance*			
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Tot.*
8	9	2	7	4	10	1				11
7	40	14	24	30	51	3		3		54
6	112	55	80	87	154	13		6	1	167
5	184	57	106	135	228	13	1	12	1	241
4	276	136	196	216	374	38	1	14		412
3	145	53	103	95	170	28	5	15		198
2	102	35	69	68	122	15	2	10		137
1	42	11	31	22	45	8	2	3		53
0	13	3	12	4	15	1				16
Tot.	*923*	*366*	*628*	*661*	*1169*	*120*	*11*	*63*	*2*	*1289*

Tables similar to IV and V could be constructed in this case if one desired to discover position statistics or to compute the values of the means and sigmas for the different groups.

CONCLUSION

We have shown how the correlation table can be printed on a tabulator equipped with digit selection and how, at the same time, information can be obtained which permits a speedy calculation of means, sigmas, correlations, and skewnesses. In addition we have shown how the various cumulative distributions can be simultaneously printed and how the means and sigmas of different categories may be obtained.

This is superior in many ways to the card counting sorter method of obtaining these distributions, since it eliminates all probability of error of transcribing and reduces the human element to a minimum.

APPENDIX

The "Digit Pick-up" is wired to control brush #5 (x variable) and the "Digit selector outlet Hubs" 0 to 9 are wired to the 10 "D" Hubs of a 10-Position X-Distributor. (If the machine is equipped with only a 5-position X-Distributor it will be necessary to make *two* runs through the machine in order to complete the table). If the totals run over 3 places it will be necessary to use a 56 counter alphabetic, or run the cards twice. The alphabetic tabulator is preferable since on the numerical tabulator it is difficult to lock out the zeros.

A "Card Count" plug is wired into the "C" hubs of all 10 X-Distributors, and is also wired directly into the "Total" counter.

The machine is set to take minor totals controlling on column 10 and distributing a card count impulse to 11 counters as described.

REVISED METHOD OF CALCULATION OF THE WHOLESALE PRICE INDEX OF THE UNITED STATES BUREAU OF LABOR STATISTICS

By Jesse M. Cutts, *Bureau of Labor Statistics, and*
Samuel J. Dennis, *Central Statistical Board*

I. INTRODUCTION

The United States Bureau of Labor Statistics official series of index numbers of wholesale prices dates from 1890.[1] In the construction of the index, there have been employed from time to time differing methods of computation. Such revisions are essential. As improved methods are developed, and as circumstances permit, changes must be made in the collection of the basic data and in the construction of index numbers. The Bureau is now engaged in an extensive revision of its wholesale price reporting service. As a part of its revision program, the Bureau has changed the method of calculation of its wholesale price index, introducing a simpler and (it is hoped) a better technique. Further revisions in method and in procedure are under consideration. The main purpose of this discussion is to acquaint the users of the index with the change in method which has now been made. Other changes will be described as they are introduced into the computations.

The wholesale price index number of the Bureau has, since 1908, been computed as a chain index. In August, 1937, however, a revision in the method of computation was completed for the period beginning with January, 1937, and henceforth the index will be computed as a fixed-base index. Both the former chain index and the recently introduced fixed-base index are of the aggregative type. The change in the method of computation, which has had no immediate effect on the level or movement of the index, was undertaken for several reasons. The revised method should theoretically yield better results than the former method, and it has, in addition, a practical advantage of considerable importance.[2]

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[1] For index numbers of wholesale prices 1890–1926, see U. S. Bureau of Labor Statistics Bulletin No. 543, *Wholesale Prices, 1930,* (Sept. 1931), Table 1, pp. 3–10; for 1926–1931, see Bulletin No. 572, *Wholesale Prices, 1931* (Jan. 1933) Table 4, pp. 15-16. Figures for subsequent periods are shown in monthly pamphlet, *Wholesale Prices* and in the *Monthly Labor Review.* Mimeographed tables covering entire period available on request from the U. S. Bureau of Labor Statistics, Washington, D. C. By splicing to other series of indexes wholesale price movements may be traced back to 1720; see G. F. Warren and F. A. Pearson, "Wholesale Prices, 1720-1889, inclusive," U.S. Bureau of Labor Statistics Bulletin No. 572, *Wholesale Prices, 1931* (Jan. 1933) pp. 111-114.

[2] The method of computation described in this article was recommended by Henry B. Arthur in his report of December, 1935, to the Committee on Government Statistics and Information Services, "Wholesale Price Work of the Bureau of Labor Statistics." Mr. Arthur has given continuing advice

II. THE FORMER METHOD

The chain index method[3] which has been used for the last 29 years was originally adopted to facilitate substitutions in price series and to simplify the task of making recurring changes in weights. By this method it is a relatively simple matter to provide for the breaks in homogeneity which occur in price series. Models or styles of a commodity become obsolete and cease to be manufactured, and new models and styles are introduced to satisfy the changing demands of a fickle public. Marketing centers shift, and the price at the marketing center formerly of principal importance must be replaced by the price at the marketing center to which the business has moved. Price-quoting practices in an industry change, and prices once quoted f.o.b. give way to delivered prices, or vice versa. Breaks of this sort can be handled in a chain index by securing overlapping price data for no more than a single month, as a direct comparison is made only between the prices for the current month and those of the preceding month. (In practice, however, when a substitution has been made, or when there has been a change in a price series, the Bureau has attempted to secure overlapping prices for a year). The Bureau of Labor Statistics index contains such a large number of price series, the official count having been 784 since the 1931 revision, that breaks in homogeneity are frequent. Consequently there is great advantage in any method by which they may be handled simply.

Furthermore, the chain index has been convenient in effecting the changes in weights which have been made periodically as the Census of Manufactures data have become available. For a dozen years prior to 1934 the revised weights were introduced at two-year intervals. Since 1934, however, no changes in weights have been made, because the weights which would normally have been introduced in 1936 were those relating to the depression years, and they appeared to be un-

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and encouragement which have been exceedingly helpful during the course of the revision. The authors also wish to acknowledge the assistance of the members of the Sub-Committee on Wholesale Prices of the Committee on Prices of the Central Statistical Board, especially Sidney W. Wilcox, Frank R. Garfield, and C. A. Purves.

[3] The chain index used has been computed in accordance with the usual formula, which may be written for the monthly index as follows:

$$I_k = \frac{\Sigma(P_k Q_h)}{\Sigma(P_{k-1} Q_h)} I_{k-1}$$

where I_k = index for the given month
P_k = price for the given month
P_{k-1} = price for the preceding month
I_{k-1} = index for the preceding month
Q_h = quantity at the time h; used as "quantity weight."

A formula of the same type has been used for the weekly and the annual indexes.

representative of the recovery period. At the present time, quantities used as "quantity weights" are averages of the data for 1929 and 1931, except for farm products, for which the quantities used are averages of the data for the three years 1929, 1930, and 1931. (This last statement applies to the revised method as well as to the former method.) When changes in weights were made the revised weights were introduced at the beginning of a calendar year. It was necessary merely to compute for the preceding December two sets of aggregates of the type $\Sigma(PQ)$, one using the former weights for comparison with November, and the other using the revised weights for comparison with January. (For a detailed description of the method, see pp. 2–5, U. S. Bureau of Labor Statistics Bulletin No. 493.) Thus the extra work necessitated by the change in weights was small, and the comparison of each pair of successive months was maintained on a homogeneous basis.

Disadvantages

Although the chain index is convenient in providing for easy substitution of one price series for another, and in facilitating changes in weights, it encounters serious practical and theoretical difficulties. The more important of these are summarized in the four paragraphs below:

1. For any month in which a substitution of one price series for another occurs, there are two cross-products for the commodity affected, one comparable with the preceding month, the other comparable with the following month. As a result, two sets of aggregates are necessary for the groups, and for the composite index. Thus the cross-products for individual commodities, and the aggregates for subgroups, groups, and the composite index are not comparable over any extended period. Because of this non-comparability of existing cross-products and aggregates, it is very difficult to compute for a past period any special index in which series are combined into groups different from the standard classification. Essentially a recomputation of the whole index from the original price and quantity data is required. Since the need for special comparisons of this sort is rather frequent, the burden of clerical work has been heavy.

2. The relative importance of a commodity in the index is often changed by the substitution of one price series for another relating to the same commodity. Such a change in relative importance occurs whenever the price level of the new series differs from that of the former series, since the same "quantity weight" is used in both cases. Examples of changes in relative importance of particular commodities are quite numerous, though such changes ordinarily have not been

large. Of the 15 substitutions in 1936 of one price series for another, there were 11 where the relative importance of the commodity changed. The greatest individual relative change was in the case of "harvester-threshers," where in the month preceding the substitution the new series was 26.4 per cent above the former series. A substitution became necessary in January, 1936, because the manufacture of the earlier model was discontinued. The price of the old model for January was $1,008.75, the "quantity weight," expressed in thousands, 15, yielding a cross-product of 15,131. Since the aggregate of all such cross-products for the agricultural implements subgroup was 205,387, harvester-threshers before the substitution represented 7.4 per cent of the entire subgroup. The price of the new model for January was $1,275.00 and the product of price by 15, the "quantity weight," was 19,125. The aggregate of all the cross-products for the agricultural implements subgroup, including the new cross-product for harvester-threshers, was 209,381. After the substitution of the new series, therefore, harvester-threshers represented 9.1 per cent of the subgroup total, as compared with 7.4 per cent noted above. In the case of storage batteries, the difference in the price levels of the new series and the former series was not so great, amounting to 23.0 per cent; the effect on the composite index, however, was greater, since the cross-product for storage batteries changed by 16,048, from 69,856 to 53,808 while the cross-product for harvester-threshers changed by only 3,994, expressed in thousands of dollars. The size of the cross-products is, of course, a measure of the relative importance of commodities in the index.

3. Comparison of indexes computed by the chain method for any two weeks or months does not in general give the same result as would be secured by a direct comparison of the prices in the two periods. This difference in the results arises even within a period during which no general change in weights has been made.

4. The method of computation employed for the chain index implies that each price series used is appropriate for multiplying by the established "quantity weight" to obtain a meaningful value aggregate. In other words, it is assumed that the particular grade and market represented by the price series used in the index provides a price near enough the average for the whole industry so that it can be multiplied by the number of units to give a valid measure of the commodities' total value. In fact, this is not always the case, even where no substitutions have been made. Moreover, a substitution which changes the level of the price series would, as has been pointed out above, render the multiplication no longer appropriate, even though the original price and quantity figures could appropriately be multiplied.

III. THE REVISED METHOD

The method recently adopted for the computation of the Bureau of Labor Statistics' wholesale price index is the customary weighted aggregate method, with a fixed base.[4] When a substitution in an individual price series is made, the new series is adjusted to the level of the former series, so that the cross-product and the aggregate remain comparable with corresponding cross-products and aggregates for preceding periods. In practice, this is accomplished by adjusting the "quantity weight" (Q_h).

For example, a substitution occurred in the price of currants in January, 1937, when the "Patras" series replaced the "Amalia" series. The discontinued series showed a price of 11.0 cents per pound for December, 1936, and the substitute series a price of 11.5 cents per pound for the same month. Examination of the nature of the two series and of their movements during the preceding five years, as shown on the top section of the chart, indicated that the relationship existing in December was typical. The ratio, $11.0/11.5 = .95652$, therefore, measures the size of the adjustment to be made in the new series in order to maintain comparability with the former series. The adjustment might have been made by multiplying the price for each month after December by the ratio, and then multiplying by the "quantity weight," 8,215, expressed in thousands, to obtain the cross-product necessary for the index. It has been simpler, however, to make a single multiplication of the "quantity weight" by the ratio found above. This yields $8{,}215 \times .95652 = 7{,}858$. The new multiplier 7,858 is used for subsequent months.

As a result of the adjustment made in the quantity figure, the number used to multiply the price series ceases (after a substitution) to have significance as a quantity.[5] It becomes a convenient *multiplier*,

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[4] The formula may be written as follows:

$$I_k = 100\,\frac{\Sigma(P_kQ_h)}{\Sigma(P_0Q_h)}$$

Where I_k = index for the given month
P_k = price for the given month
P_0 = price for the base year (1926)
Q_h = quantity at the time h.

For the purpose of comparison the formula previously used is repeated here as follows:

$$I_k = \frac{\Sigma(P_kQ_h)}{\Sigma(P_{k-1}Q_h)}\,I_{k-1}$$

In using these formulae it should be noted that Q_h in the former method represents an actual quantity. In the revised method Q_h represents an actual quantity except in case of a substitution when it ceases to have significance as a quantity.

[5] Adjustment of the quantity figure raises certain problems in connection with the computation of an average price for a group of series. Computation of such an average price is rarely appropriate,

which keeps the relationship between the cross-product for the commodity involved in the substitution and the aggregate for the subgroup or group the same as before the substitution.

The introduction of the fixed-base method requires, of course, the computation of a comparable aggregate $\Sigma(P_0Q_h)$ for the base year, for each subgroup and group and for the composite index. On account of the general changes in weights which have been made since the base year (1926), and because of the substitutions in price series which have occurred, it was not feasible to compute these base aggregates directly. Therefore, the base aggregates used were obtained by dividing the aggregates for December, 1936, by the index numbers for the same month, which it will be recalled are on the 1926 base. The aggregates thus found preserve the comparability of the indexes computed by the revised method with indexes computed by the former method.

The computation of the base aggregate for the "grains" subgroup illustrates the method which was followed. The aggregate for the "grains" subgroup for December, 1936, was 1,548,616, in thousands of dollars. The index for this subgroup for the same month was 109.00, on the 1926 base. The aggregate for the base year 1926 was calculated by dividing 1,548,616 by 109.00 and multiplying by 100, thus obtaining 1,420,749. This base aggregate was then used to divide the aggregate for the subgroup for each month after December, 1936, in order to obtain the corresponding subgroup index. Obviously, division of the aggregate for December, 1936, (1,548,616) by the base aggregate 1,420,749 and multiplication of the result by 100, yield the original index for December (109.00). Since aggregates for months following December have been made comparable with the aggregate for December, indexes for these months are likewise comparable with the December index.

Appraisal of Revised Method

The revised method of computation escapes the serious practical difficulty and avoids several, though not all, of the theoretical diffi-

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because the units are usually heterogeneous. In some cases, however, it may be proper. For example, an average might be computed for the 18 butter series. In such instances, before any substitutions, the average price would ordinarily be obtained by dividing the aggregate of the cross-products for the group by the sum of the "quantity weights." After a substitution, one of several procedures might be followed, depending upon the purpose and upon the circumstances. If an average price comparable with preceding average prices were desired for the purpose of indicating price changes from one period to another, the aggregate of the cross-products should be divided by the sum of the unadjusted "quantity weights." If, on the other hand, an average price is desired to indicate as precisely as possible the level of prices for the commodity at a single time, a different divisor would probably be necessary. The aggregate might be divided by the sum of the adjusted "quantity weights," or an entirely new computation might be made.

culties inherent in the former method. Its success in dealing with these problems is outlined in the five paragraphs below:

1. Since the essence of a fixed base index is a series of comparable cross-products and aggregates, the regrouping of commodities into special combinations is a relatively simple matter. In this practical respect, the advantage over the chain index is significant.

2. The relative importance of a commodity is unaffected by the substitution of one price series for another, no matter how much difference there may be between the levels of the two series. In this respect, the revised method is eminently successful.

3. The revised index will not in general give the same result for a given month as would be secured by comparing the prices in that month directly with prices in the base period. This situation arises because of the changes in weights which have been made since 1926, and because of the use of the former method until the end of 1936; it is not a result of the type of index. Within the period of use of the revised method, at least until another change in weights is made, the comparison of any two months on the 1926 base will yield the same result as would be secured by comparing prices in one month directly with prices in the other.

4. Where the original price series could appropriately be multiplied by the quantity figure derived from Census data, the fixed-base index maintains the appropriateness of the multiplication even though substitutions are made. Where the multiplication was not appropriate in the first instance, this index maintains the inappropriateness. This problem is essentially associated with the aggregative form of index.[6] It is a problem to which the Bureau of Labor Statistics intends to give consideration during the current program for revision and expansion of its wholesale price reporting service.

5. As the accompanying table indicates, the differences between indexes computed in accordance with the former method and those using the revised method have been so small during the period since January, 1937, that the advantage of the revised method on theoretical grounds is not demonstrated. Over a longer period, however, differences between the results of the two methods are almost certain to arise, and may prove substantial for some of the subgroups and groups. In such cases, the results of the revised method should be more satisfactory, because in the revised method the relative importance of a commodity

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[6] For a discussion of this point see H. B. Arthur, "Weighted Aggregates and Index Numbers," This JOURNAL, 32 (1937), 362.

is unaffected by substitutions, while in the former method the relative importance of a commodity could be changed.

Introduction of Revised Method into Computation

The revised method was introduced into the monthly index with the computation of the figure for July, 1937, and its use has been extended back to January, 1937. Comparable aggregates thus exist for each month beginning with December, 1936. The differences in the results obtained by the former method and by the revised method have been so small during the period of overlap that a direct substitution has been possible. The effect on a group index, rounded to the nearest tenth of a per cent, was in no case more than 0.1 per cent. The greatest difference for any subgroup index was 0.4 per cent.

The introduction of the revised method into the weekly index has not been completed at the time of writing. It is expected, however, that the weekly indexes will be currently computed in accordance with the revised method before the end of 1937, and that the computation will be extended back for a brief period before the date of introduction. When the revised method of computation is introduced into the weekly index, there will be a slight break in homogeneity in the composite index and in most of the group indexes. As a result of the chain method, the weekly indexes have wandered away slightly from the monthly index, though the largest discrepancy for any group is at the present time only 1.8 per cent. When the revised method of computation is introduced, the weekly indexes will be brought to the level of the monthly indexes, and should in the future remain at approximately the same level as the monthly indexes. The divergencies that may arise from time to time should be small in amount and random in direction.

IV. TECHNIQUE OF SUBSTITUTION

The substitution of one price series for another may properly be made only where it is clear that the two series relate to the same market (in the broad sense). In all cases where a series is discontinued, therefore, it is necessary to investigate the discontinued series together with any series that may be available as possible substitutes. The object of this investigation is to determine the precise market to which the discontinued series related, and to select a substitute series which represents the same market. In any case in which a former series has become non-representative of the market which it was originally intended to describe, it may be necessary to introduce the new series at some date previous to that at which the necessity for substitution arose, and to make corresponding revisions in the indexes for intervening months.

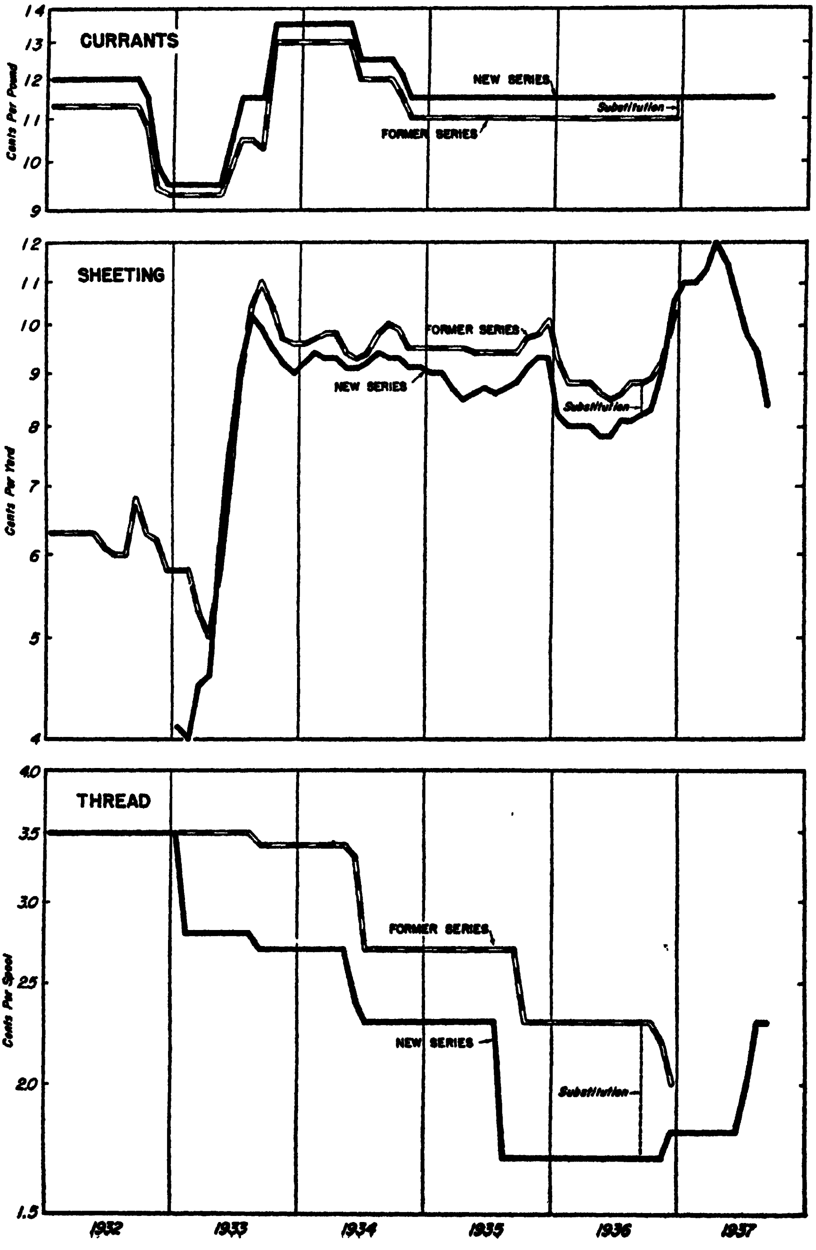
When a satisfactory substitute series has been selected, the adjustment of the quantity multiplier to take account of the substitution should, of course, be made on the basis of the typical relationship between the two series.

The substitutions that had been made in accordance with the former method of computation between January and July, 1937, were reexamined to assure their validity, and all were found to be satisfactory. Consequently each pair of series was tested to determine the typical relationship. A semi-logarithmic chart was drawn comparing the two series for the period beginning with January, 1932, or for as much of this period as both were available. In almost all cases, graphic inspection showed a reasonably consistent relationship between the two series concerned. Price fluctuations came at the same, or nearly the same, times and were of approximately the same magnitude in the two series. Where this condition existed, and where the price-spread in the last month before the substitution appeared to be about the same as that during the entire period, the last month was used as the basis for computing the ratio of the substitute series to the former series. An adjustment based on a single month may be theoretically objectionable, but the objections should be largely answered by the use of a single month only where it is apparently typical. Moreover, use of a single month creates no problem of a break at the time of substitution, which might occur if a broader period were used as the basis for the adjustment. Finally, the use of a single month reduces the amount of revision of back data, and requires less clerical work than use of a broader period.

In several cases (mainly among the furniture items) overlapping price data could be obtained for no more than a single month. Here, apparently, when one style is replaced by another the process is abrupt, and the old styles are withdrawn completely as soon as the new are placed upon the market. An examination of the spread during previous months could not be made, and the single month of overlap was necessarily accepted as typical. It is hoped that in the approaching revision of the furniture series, a more satisfactory treatment of this problem of style changes can be developed; but in the meantime no other solution was possible.

In most cases, the last month before the substitution could properly be taken as providing a typical spread between the two series. However, there were a few instances in which this was not possible. A situation which will probably occur fairly frequently was found in the case

WHOLESALE PRICES OF SELECTED COMMODITIES
Monthly 1932–1937
(Logarithmic vertical scale)



of cotton sheeting. The Bureau had been quoting prices on an unbleached sheeting with a thread count of 64×64, running 3.72 yards to the pound. The reporting of this series was discontinued by the manufacturer, and a substitute series of prices was selected for a different grade of sheeting with a thread count of 64×68, running 3.50 yards to the pound. From late 1933 until October, 1936, as the accompanying chart shows, the price of the substitute series was consistently below the price of the discontinued series by a nearly constant relative amount. From that time on, both series rose quite vigorously, but the substitute series rose much farther than the discontinued series, so that it was actually above the discontinued series in December, the last month in which the discontinued series was quoted. On investigation, it was learned that the former series was no longer being manufactured. In order to close out remaining stocks at a time when the market for cotton goods was rising very rapidly, the price of the former series was advanced more slowly than the prices of similar goods. The price rise of the substitute series was definitely a better measure of the market at the time. Consequently, December, 1936, could not properly be used

COMPARISON OF INDEX NUMBERS OF WHOLESALE PRICES USING THE FORMER METHOD OF COMPUTATION AND THE REVISED METHOD OF COMPUTATION

By Groups of Commodities, January to May 1937, Inclusive
(1926 = 100)
Column (a) Former Method
Column (b) Revised Method

Groups	January		February		March		April		May	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
All commodities	85.90	85.93	86.27	86.27	87.77	87.76	87.97	87.91	87.38	87.37
Farm Products	91.49	91.52	91.38	91.41	94.05	94.11	92.20	92.19	89.76	89.75
Foods	87.08	87.07	86.98	86.98	87.53	87.53	85.46	85.46	84.18	84.17
Hides & leather products	101.71	101.74	102.72	102.75	104.17	104.19	106.30	106.32	106.70	106.73
Textile products	77.50	77.50	77.50	77.50	78.28	78.24	79.55	79.55	78.74	78.73
Fuel & lighting materials	76.59	76.59	76.77	76.76	76.16	76.15	76.34	76.33	77.17	77.06
Metals & metal products	90.91	90.91	91.71	91.71	95.99	95.98	96.55	96.55	95.79	95.79
Building materials	91.32	91.33	93.29	93.30	95.86	95.88	96.72	96.74	97.16	97.18
Chemicals & drugs	87.69	87.69	87.75	87.75	87.54	87.54	86.92	86.92	84.46	84.46
Housefurnishing goods	86.64	86.59	87.92	87.87	88.44	88.39	88.95	88.97	89.30	89.32
Miscellaneous	76.16	76.15	77.26	77.23	79.46	79.41	81.10	81.05	80.55	80.50

NOTE: The indexes are presented here to hundredths for more exact comparison of the two methods. In official publications the indexes are given to tenths, as the significance of the second decimal is doubtful.

as the overlap period. The index was therefore revised back through October, 1936, introducing the substitute series in that month. Since the aggregates have been made comparable only beginning with December, the substitution was made by the chain method, and the quantity multiplier was not changed. If an adjustment of the quantity multiplier had been made, however, it would have been done on the basis of September, 1936.

A second series that raised a problem is presented in the bottom section of the chart. The former series for cotton thread was reported to the Bureau as an unweighted average of the prices for 8 to 200 ticket. The substitute series was reported as an unweighted average of the prices of 40, 50, and 60 ticket only, which represent the bulk of the total business. Although the sizes of thread included in the substitute series were also included in the former series, the two series had peculiar differences in movement. No typical spread appeared. However, since the upward movement shown by the substitute series between November, and December, 1936, was a better measure of the price change for cotton thread than the downward movement of the former series between October and December, it was decided to make the substitution in October, 1936, revising the index back to that time. As in the case of cotton sheeting, no adjustment in the multiplier was made; if an adjustment had been made, it would have been on the basis of the overlap in September.

THE USE OF RANKS TO AVOID THE ASSUMPTION OF NORMALITY IMPLICIT IN THE ANALYSIS OF VARIANCE

By Milton Friedman
National Resources Committee

Most projects involving the collection and analysis of statistical data have for one of their major aims the isolation of factors which account for variation in the variable studied. The statistical tool ordinarily employed for this purpose is the analysis of variance. Frequently, however, the data are sufficiently extensive to indicate that the assumptions necessary for the valid application of this technique are not justified. This is especially apt to be the case with social and economic data where the normal distribution is likely to be the exception rather than the rule. This difficulty can be obviated, however, by arranging each set of values of the variate in order of size, numbering them 1, 2, and so forth, and using these ranks instead of the original quantitative values. In this way no assumption whatsoever need be made as to the distribution of the original variate.

The utilization of ranked data is thus frequently a desirable device to avoid normality assumptions; in addition, however, it may be inescapable either because the data available relate solely to order, or because we are dealing with a qualitative characteristic which can be ranked but not measured.

The possibility of using ranked data in problems involving simple correlation and thereby avoiding assumptions of normality has recently been emphasized in an article by Harold Hotelling and Margaret Richards Pabst.[1] It is the purpose of the present article to outline a procedure whereby the analysis of ranked data can be employed in place of the ordinary analysis of variance when there are two (or more) criteria of classification. This procedure has two major advantages. As already indicated, it is applicable to a wider class of cases than the ordinary analysis of variance. In addition, it is less arduous than the latter technique, requiring but a fraction as much time. The loss of information through utilizing the procedure outlined below when the analysis of variance could validly be applied may thus be more than compensated for by its greater economy. This consideration is likely to be especially important with those large scale collections of social and economic data which have become increasingly frequent in recent years and for which the funds available for analysis are limited.

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[1] "Rank Correlation and Tests of Significance Involving No Assumption of Normality," *Annals of Mathematical Statistics*, VII (1936) 29–43.

THE PROCEDURE

The procedure, which I shall call the *method of ranks*, involves first ranking the data in each *row* of a two-way table and then testing to see whether the different *columns* of the resultant table of ranks can be supposed to have all come from the same universe. This test is made by computing from the mean ranks for the several columns a statistic, χ_r^2, which tends to be distributed according to the usual χ^2 distribution when the ranking is, in fact, random, i.e., when the factor tested has no influence.

The details of the procedure can best be explained by presenting an example. Table I gives the standard deviations of expenditures on different categories of expenditure for seven income levels.[2] It is de-

TABLE I

STANDARD DEVIATIONS AT DIFFERENT INCOME LEVELS* OF EXPENDITURES ON THE MAJOR CATEGORIES DURING 1935–36 OF 246 MINNEAPOLIS AND ST. PAUL FAMILIES OF WAGE-EARNERS AND LOWER SALARIED CLERICAL WORKERS†

Category of expenditure	Annual family income						
	$750–1,000	$1,000–1,250	$1,250–1,500	$1,500–1,750	$1,750–2,000	$2,000–2,250	$2,250 2,500
Housing	$103.3	$68.42	$89.53	$77.94	$100.0	$108.2	$184.9
Household operation	42.19	44.31	60.91	73.90	43.87	61.74	102.3
Food	71.27	81.88	100.71	86.52	100.3	90.75	100.6
Clothing	37.59	60.05	56.97	60.79	71.82	83.04	117.1
Furnishings and equipment	58.31	52.73	96.04	60.42	104.33	89.78	85.77
Transportation	46.27	82.18	129.8	181.0	172.33	164.8	246.8
Recreation	19.00	23.07	38.70	45.81	59.03	50.69	55.18
Personal care	8.31	8.43	9.16	14.28	10.63	15.84	12.50
Medical care	20.15	33.48	60.08	69.35	114.34	45.28	101.6
Education	3.16	4.12	12.73	18.95	8.89	41.52	66.33
Community welfare	4.12	18.87	8.54	12.92	25.30	19.85	16.76
Vocation	7.68	11.18	10.44	10.95	10.54	13.96	14.39
Gifts	5.29	10.91	11.22	25.26	42.25	48.80	69.38
Other	6.00	5.57	22.23	2.45	6.24	1.00	4.00

* In computing the standard deviations the influence of family composition (in terms of number of members and their age) was eliminated by grouping the families at each income level into similar family types and computing the sums of squares within such income-family type groups. These sums of squares were summed for the family types at each income level and divided by the number of degrees of freedom. This gave the variance at each income level. It is the square roots of the variances which are entered in the table.

† The figures in this table are based on schedules collected by the Cost of Living Division of the U. S. Bureau of Labor Statistics. These schedules were loaned to the National Resources Committee for special analyses, of which this is one.

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[2] The figures given in Table I were obtained from schedules on the receipts and disbursements of families of wage earners and lower salaried clerical workers during 1935–36 collected in Minneapolis and St. Paul by the Cost of Living Division of the U. S. Bureau of Labor Statistics. These schedules were loaned to the National Resources Committee for special analyses, several of which are used in this article.

sired to determine whether the standard deviations differ significantly for the different income levels.

The first step is to form Table II from Table I by ranking the standare deviations for each category, giving the lowest value a rank of 1,

TABLE II

RANKING OF INCOME LEVELS BY SIZE OF STANDARD DEVIATION FOR EACH CATEGORY OF EXPENDITURE*

Category of expenditure	Annual family income						
	$750–1,000	$1,000–1,250	$1,250–1,500	$1,500–1,750	$1,750–2,000	$2,000–2,250	$2,250–2,500
Housing	5	1	3	2	4	6	7
Household operation	1	3	4	6	2	5	7
Food	1	2	7	3	5	4	6
Clothing	1	3	2	4	5	6	7
Furnishings and equipment	2	1	6	3	7	5	4
Transportation	1	2	3	6	5	4	7
Recreation	1	2	3	4	7	5	6
Personal care	1	2	3	6	4	7	5
Medical care	1	2	4	5	7	3	6
Education	1	2	4	5	3	6	7
Community welfare	1	5	2	3	7	6	4
Vocation	1	5	2	4	3	6	7
Gifts	1	2	3	4	5	6	7
Other	5	4	7	2	6	1	3
a. Total	23	36	53	57	70	70	83
b. Mean rank	1.643	2.571	3.786	4 071	5.000	5.000	5.929
c. Deviation	−2.357	−1.429	−.214	.071	1.000	1.000	1.929

Sum of squared deviations = 13.3692

$\chi_r^2 = 40.108$

* The figures in this table are derived from Table I.

the next lowest rank of 2, etc.[3] Thus, in each row of Table II, we have a set of numbers from 1 to 7, since there are seven income levels.

On the hypothesis that for any one category the value of the standard deviation is the same at all income levels, differences among the values in each row of Table I will arise solely from sampling fluctuations. The rank entered for a particular income level would then be a matter of chance; in repeated samples each of the numbers from 1 to 7 would appear with equal frequency.[4]

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[3] It is, of course, immaterial whether the ranking is from the lowest to the highest or the reverse, i.e., from the highest to the lowest.

[4] This statement is strictly valid only if the different entries in the same row are assumed to come from the same universe—no matter, of course, what its nature. In the present example it requires some qualification since the standard deviations in each row are not all based on the same number of cases. In this case, while two entries in the same row of the original table (e.g., Table I) will have the same expected value, one will exceed the other more than half the time. The reason for this is that the

If, therefore, the standard deviation were independent of the income level, the set of ranks in each *column* would represent a random sample of 14 items (that being the number of categories of expenditure) from the discontinuous rectangular universe—1, 2, 3, 4, 5, 6, 7. The mean of this universe is 4, or, in general, $\frac{1}{2}(p+1)$, where p is the number of ranks. The variance is also 4, or in general $(p^2-1)/12$.[5]

The next step in the procedure is to obtain the mean rank for each column. These are given on line b of Table II. In the absence of a relation between the standard deviations and income level, these means are all estimates of the same thing, namely of the mean of the rectangular universe. Moreover, the sampling distribution of the means will be approximately normal so long as the number of rows is not too small.[6]

The sampling distribution of the mean ranks (where $\bar{r}_j$ is the mean rank of the j-th column) will have a mean value (ρ) of $\frac{1}{2}(p+1)$ and a variance σ^2 of $(p^2-1)/(12\,n)$, where n is the number of rows, i.e., the number of ranks averaged.[7]

Since the true mean and true standard deviation of the chance universe are known, the hypothesis that the means come from a single homogeneous normal universe can be tested by computing

$$\chi_r{}^2 = \frac{p-1}{p\sigma^2}\sum_{j=1}^{p}(\bar{r}_j-\rho)^2 = \frac{12n}{p(p+1)}\sum_{j=1}^{p}\left\{\bar{r}_j-\tfrac{1}{2}(p+1)\right\}^2 .$$

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sampling distribution of the ratio of two variances is not symmetrical unless both variances are based on the same number of degrees of freedom. The mean value of the ratio is approximately unity, but the median is not equal to one—it is less than one if the numerator is based on fewer degrees of freedom than the denominator, and conversely. In ranking *two* standard deviations, therefore, the one based on the smaller number of cases would receive a rank of 1 more than half the time. When more than two standard deviations are ranked this tendency is somewhat compensated for by the greater probability that those based on the fewest cases will receive relatively high ranks, and thus the average rank will be less affected. This difficulty does not, however, affect the validity of the illustrative analysis presented here, since the two highest income classes contain the smallest numbers of families but have the highest average ranks.

More generally, when the entries in different columns of the same row come from symmetrical universes with the same mean but different variances, the several ranks will have the same *expected* value, but the probability distribution for each cell will not be exactly rectangular. This condition of symmetry is a sufficient condition for the ranks to have the same expected value; it is, however, more stringent than is necessary. This difficulty clearly calls for further analysis.

[5] The sum of the numbers from 1 to p is $\frac{1}{2}p(p+1)$. The mean is therefore $\frac{1}{2}(p+1)$. The sum of the squares of the numbers from 1 to p is $(2p+1)(p+1)p/6$. The variance is, therefore, $(2p+1)(p+1)/6 - \frac{1}{4}(p+1)^2 = (p^2-1)/12$.

[6] That the sampling distribution of samples drawn from a rectangular universe approaches normality quite rapidly is, of course, well known. The distribution of means for samples of two is a triangle; for samples of three it is made up of three parabolic segments, the first and third concave upwards, and the middle one concave downward. An empirical distribution for samples of ten is given by Hilda Frost Dunlap, "An Empirical Determination of the Distribution of Means, Standard Deviations and Correlation Coefficients Drawn from Rectangular Populations," *Annals of Mathematical Statistics*, II (1931), 66–81. The universe sampled was a discontinuous rectangular universe, including the integers from 1 to 6. The empirical distribution shows extremely close conformity to the normal curve.

[7] This follows from the fact that the variance of a mean of n observations of equal weight is $1/n$ times the variance of an individual observation.

So long as the number of rows and columns is not too small, χ_r^2 computed in this way will be distributed according to the usual χ^2 distribution with $p-1$ degrees of freedom.[8] If, now, χ_r^2 is significantly greater than might reasonably have been expected from chance, the implication is that the mean ranks differ significantly, i.e., that the size of the standard deviation depends on the income level.

The computation of χ_r^2 is extremely simple. The mean of the seven mean ranks is, of necessity, equal to the true mean of 4. The difference between the mean rank for each column and 4 is given on line c of Table II. The sum of the squares of these differences is 13.3692 and $\chi_r^2=40.1076$.

This illustrative computation has been made using a formula that makes clear the nature of χ_r^2. In actual practice the following alternative formula which involves only integers and makes unnecessary the computation of the actual mean ranks will be found more convenient:

$$\chi_r^2 = \frac{12}{np(p+1)} \sum_{j=1}^{p} \left(\sum_{i=1}^{n} r_{ij} \right)^2 - 3n(p+1),$$

where r_{ij} is the rank entered in the i-th row and j-th column.

The number of degrees of freedom on which this estimate is based is $p-1=6$. For six degrees of freedom the value of χ^2 which would be exceeded by chance once in 20 times is 12.592, and once in a hundred times, 16.812.[9] The probability of a value greater than 40 is .000001.[10] There can thus be little question that the observed mean ranks differ significantly, i.e., that the standard deviation is related to the income level. From the mean ranks it is seen that with but one minor exception the standard deviations consistently increase with income.

Since the value of χ_r^2 is invariant under transpositions of the columns of ranks under their captions this information—that the ranks increase with income—has not been utilized. Whenever the columns themselves can be ranked, the additional information supplied by the relationship between the order of the mean ranks and the order of the columns can be used by computing a rank difference correlation between the two corresponding sets of ranks, determining the probability that the correlation coefficient obtained would have been equalled or exceeded by chance, converting this probability into the value of χ^2

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[8] For a justification of the formula for χ_r^2 and of the statement that χ_r^2 tends to be distributed like χ^2, as well as for some indication of the number of columns and rows necessary, see pp. 687–694 and the mathematical appendix.

[9] Fisher, R. A., *Statistical Methods for Research Workers*, Table III.

[10] Pearson, Karl, *Tables for Statisticians and Biometricians*, 3rd Edition, London, 1930, Part, I Table XII.

which corresponds to it for two degrees of freedom, and pooling the resultant value of χ^2 with χ_r^2.[10a] In the present illustrative example the evidence is so clear that this additional information will obviously not affect the conclusion. It will, however, serve to exemplify the procedure. The rank difference correlation between the mean rank and the income level is .991. (In deriving this coefficient the tied ranks were treated in the manner suggested below, i.e., they were assigned the average value of the ranks for which they were tied.) The probability of securing a value as great as or greater than this is between .00277 and .00040. The value of χ^2 corresponding to the larger of these figures for two degrees of freedom is $-2 \log_e .0277 = 11.77$. Adding this to χ_r^2 gives 51.88 as the value to be entered in the χ^2 table for 8 degrees of freedom. The probability associated with this value is smaller than that for χ_r^2 and, indeed, is so small that it cannot be determined from the published tables.

In order to test whether the standard deviations are related to the type of expenditure it is only necessary to repeat the above analysis; this time, however, treating the columns is the way in which the rows were previously treated, and *vice versa*. Thus the standard deviations would be ranked for each income level, and the mean ranks obtained for each type of expenditure.

It might appear offhand as if the procedure used to study the relation between standard deviations and income level does not make use of all of the information provided by Table II, that it neglects the distribution of the ranks within the columns, and that this supplies additional information about the consistency of the ranking. This, however, is not the case. Since Table II must contain n 1's, n 2's, . . . , n p's, the total sum of the squared deviations from the grand mean is the same no matter what the arrangement of the ranks within the table—it is, in fact, equal to $np(p^2-1)/12$. The sum of squares within columns plus the sum of squares between columns must add up to this total. Knowledge of one of these sums of squares thus implies knowledge of the other. In the above example we have used the sum of squares between columns; no additional information is thus supplied by the sum of squares within columns.

It should be noted that in testing the significance of the differences among the columns no assumption whatsoever needs to be made as to the similarity of the distribution of the original variate for the different rows. The test takes the form of comparing the mean ranks for the several columns; essentially, however, the null hypothesis tested is that the original entries in each row are from the same universe; whether or not this universe is the same for the different rows is entirely irrelevant to the validity of the test.

[10a] See Hotelling and Pabst, *op. cit.*, pp. 35 and 40, and Fisher, *op. cit.* art., 21.1.

The method of ranks does not provide for testing "interaction." It is of the very nature of the method that it cannot do so. Without exact quantitative measurement, "interaction," in the sense used in the ordinary analysis of variance, is meaningless.

It should further be noted that the method of ranks may not provide a test of the influence of a factor if there is reason to suspect that this influence is in a different *direction* for the different rows; if, for example, the standard deviation increases with income for certain types of expenditure and decreases with income for others. For in such a case the mean ranks of the p columns may all have the same expected value, although the p ranks for each of the rows do not. Thus, if χ_r^2 is significant, the conclusion is that the ranking is not random. But χ_r^2 may not be significant, not because the ranking is random, or because the differences in the mean ranks are too small for the observed sample to display significance, but because the influence of the factor tested is different in direction for the different rows. In this connection, however the general point should be emphasized that non-significant results do not establish the validity of the null hypothesis in the same way that significant results tend to contradict it.

In some cases two (or more) of the values of the variate in a row will be identical, i.e., there will be "tied" ranks. Two procedures can be followed: first, the ranks tied for can be assigned to the two (or more) values at random; or second, each value can be given the average value of the ranks tied for (e.g., if two values are tied for the ranks 2 and 3 each can be given the rank of 2.5). In general, the second of these procedures seems to be preferable, since it uses slightly more of the information provided by the data.[11] The substitution of the average rank for the tied values does not affect the validity of the χ_r^2 test.[12]

THE EFFICIENCY OF THE METHOD OF RANKS RELATIVE TO THE ANALYSIS OF VARIANCE

It is evident that the method of ranks does not utilize all of the information furnished by the data, since it relies solely on order and makes no use of the quantitative magnitude of the variate. It is this very fact that makes it independent of the assumption of normality. At the same time, it is desirable to obtain some notion about the amount of information lost, that is, about the efficiency of the method of ranks in situations where the analysis of variance provides the proper test.[13]

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[11] This alternative method of handling tied ranks and its advantages were brought to my attention by Mr. W. Allen Wallis, who has developed a simple adjustment to the usual formula for the rank-difference correlation to allow for the treatment of tied ranks in this fashion.

[12] Its only effect is to change very slightly the "true" value of the variance. In the extreme case when tied ranks are as probable as untied ranks, the variance of an individual observation is changed from $(p^2-1)/12$ to $p(p-1)/12$, i.e., it is reduced by $(p-1)/12$ or in the ratio of 1 to $p+1$. The reduction is thus relatively small when p is moderately large.

For the special case of $p=2$ (i.e., of two ranks) the method of ranks is equivalent to the binomial series test of significance of a mean difference, that is, it is equivalent to testing whether the proportion of positive differences between the pairs of values in each row of the $2\times n$ table (the proportion of 2's in the first column of the table of ranks) differs significantly from $\frac{1}{2}$.[14] Now, W. G. Cochran recently showed[15] that the binomial series test of a mean difference has an efficiency of 63.7 per cent. It follows that the method of ranks, for the special case of $p=2$, likewise has an efficiency of 63.7 per cent.

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[13] By the "efficiency" of a statistic m used to estimate a parameter μ is meant the ratio of the variance of the maximum likelihood estimate of μ to the variance of m. The difference between this ratio and unity multiplied by 100 gives the percentage of "information" lost. (R. A. Fisher, *op. cit.*, Chapter IX.)

In the present instance, since the analysis of ranks and the analysis of variance provide estimates of different parameters—in the one case, of χ_r^2, and in the other, of the analysis of variance ratio—it is first necessary to secure a relationship between the two parameters which can be used to estimate one from the other. In this way both methods can be used to estimate the same parameter.

[14] The analogous method for p greater than 2, while it provides a method for analyzing a table of ranks and seems superficially closely related to the method of ranks, is essentially very different.

This alternative procedure involves the formation from the basic table of ranks of a $p\times p$ contingency table giving the number of ranks of each size in each column. Thus, one of the classifications is by column number, the other by the value of the rank. Such tables can then be analysed by computing χ^2 in the usual manner and testing its significance. Unless the number of rows is large *relative to the number of columns*, the usual χ^2 tables will, of course, not be applicable. Exact distributions can, however, be obtained in the manner indicated by F. Yates ("Contingency Tables Involving Small Numbers and the χ^2 Test," *Journal of the Royal Statistical Society*, Supplement, Volume I (1934), pp. 217-35).

This procedure does not, however, test the same hypothesis as the method of ranks. The reason is that with the contingency table method the numerical values of the ranks in no way affect the result, whereas in the method of ranks they do. Thus, consider the following 3×3 tables of ranks:

A.	1	2	3	B.	1	2	3
	1	2	3		1	2	3
	3	2	1		1	3	2

It is clear that B indicates greater departure from the hypothesis that the ranking is random than does A. Both tables contain one column in which all three ranks are identical and two columns in which two out of three ranks are the same. But in B these latter two columns contain ranks which vary less than for the corresponding columns of A. Stated differently, in B *every* rank in the last two columns is greater than *any* rank in the first; no comparable statement is valid for A.

The contingency analysis would indicate, however, that A and B diverge equally from expectation, since both will give contingency tables which, except for permutations of rows and columns, are identical. The method of ranks, on the other hand, will indicate that B diverges more from expectation than A; χ_r^2 is $4\frac{2}{3}$ for B, but only $\frac{2}{3}$ for A.

For the purpose of determining whether one variable has a significant influence on another, it seems clear that the method of ranks is definitely preferable to the contingency analysis just outlined.

The reason why the two methods are equivalent for $p=2$ is evident; when there are only two ranks, there is no possibility of different ranks diverging by varying amounts.

[15] "The Efficiencies of the Binomial Series Tests of Significance of a Mean and of a Correlation Coefficient," *Journal of the Royal Statistical Society*, C (1937), 69-73.

Moreover, this provides a measure of the *minimum* efficiency of the method of ranks. When $p=2$, a classification in terms solely of greater or smaller is substituted for the exact quantitative measurements; as p increases a more and more finely subdivided scale is substituted for the exact measurements. It seems reasonable, therefore, that the loss in information through using ranks decreases as p increases.

For the special case of $n=2$, it is shown below that χ_r^2 and the rank difference correlation are essentially equivalent. On the assumption that the true correlation is zero, Hotelling and Pabst have shown that the efficiency of the rank difference correlation approaches 91.19 per cent as p increases. In their words, "the product-moment correlation is approximately as sensitive a test of the existence of a relationship in a normally distributed population with 91 cases as the rank correlation with 100 cases."[16]

For the more general case, when p and n are greater than 2 I have not been able to determine the efficiency of the method of ranks. It seems clear, however, that the loss of information is less than the 36 per cent lost when $p=2$ and probably greater than the 9 per cent lost when $n=2$.

In the absence of the theoretical analysis there are presented here the results of applying both the analysis of variance and the method of ranks to the same data. A comparison of these results will, of course, offer no conclusive evidence as to the relative efficiency of the two methods; but it should at least suggest whether the loss of information in using the method of ranks is so great as to vitiate completely its usefulness.

The data analyzed are the same as those utilized in the illustrative analysis summarized in Tables I and II above, i.e., they are data on the expenditures and savings during 1935–36 of 246 Minneapolis and St. Paul families of wage earners and lower salaried clerical workers. In the present instance, however, the analysis is directed toward determining whether income and family composition have a significant influence on the expenditures for the various categories and on savings. The analysis given above, it will be recalled, attempted to determine whether income had a significant influence on the *standard deviations* of expenditure.

The 246 families have been grouped into seven income classes,[17] each $250 in range, and five family composition types.[18] This gives 35 groups in all.

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[16] *Op. cit.*, pp. 42–43.

[17] The total income of a family is defined as including not only money income, but also the imputed value of gifts in kind, of food produced at home and of the use of a home owned by the family.

For each of the major categories of expenditures, for savings, and for certain sub-groups of items, three variances have been computed: the variance (1) between income levels, (2) between family types, and (3) within groups.[19]

For 14 major categories of expenditure, for 13 sub-groups of several of these categories, and for savings, there was computed the ratios of the variance between income levels and the variance between family types to the variance within groups. These ratios, designated as F_i and F_f respectively, are given in Table III.

To each of the 28 items considered, the method of ranks was also applied to test the influence of income and family type.

In testing the influence of income, the seven mean expenditures for each family type were ranked. This gave five sets of seven ranks. In testing the influence of family type the procedure was reversed; the five mean expenditures at each income level were ranked, giving seven sets of five ranks.

The results of the method of ranks are likewise given in Table III. This table gives the values of χ_r^2 computed in testing for the influence of income, as well as those obtained in testing for the influence of family type.

For both the analysis of variance and the method of ranks the values which are significant at the .01 level are indicated with a double star; those which are significant only at the .05 level, with a single star.

The two methods yield measures of the influence of income and family type for 28 items. There are thus 56 independent analyses by each method. In Table III these measures are classified into three

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[18] The family types are defined as follows:

Type 1 Husband, wife, and one child under 16
2 Husband, wife, and two children under 16
3 Husband, wife, one person 16 or over, and one or no other persons
4 Husband, wife, one child under 16, one person 16 or over, and one or two other persons
5 Husband, wife, and three or four children under 16.

[19] There was also computed the variance due to interaction. Since the method of ranks can give no measure of interaction, this variance is of no interest here. It is worth pointing out, however, that interaction was significant for only three out of 28 cases; for one of those the probability was between .05 and .01 and for two it was less than .01.

Since the numbers of items in the subclasses are neither equal nor proportionate, there is some difficulty in decomposing the variation between groups. The variances between income levels and between family types were computed by the method of weighted squares of means. This method does not give an estimate of interaction when there are more than two classes for both of the factors. Consequently, the variance due to interaction was computed by the method of unweighted means.

For an excellent statement of the difficulties raised by disproportionate subclass numbers and of the available methods of analysis, see G. C. Snedecor, and G. M. Cox, "Disproportionate Subclass Numbers in Tables of Multiple Classification," Research Bulletin 180, Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts (March 1935).

TABLE III

RESULTS OF ANALYSIS OF VARIANCE AND METHOD OF RANKS

Measures of the Influence of Income and Family Type on Expenditures for the Major Categories of Expenditure and for Sub-Groups of Items, and on Savings, Based on Data on the Expenditures and Savings During 1935–36 of 246 Minneapolis and St. Paul Families[1]

Item	Analysis of variance Ratios of variances[2]		Method of ranks χ_r^2	
	Income F_i	Family type F_f	Income	Family type
Major categories of expenditure[3]				
Food	15.33**	5.75**	27.02**	19.09**
Household operation	9.95**	1.01	24.24**	4.94
Housing	9.50**	1.63	21.94**	6.17
Clothing	9.40**	1.38	25.54**	9.46
Recreation	4.25**	1.98	23.83**	11.89*
Personal care	4.10**	.80	21.11**	4.14
Transportation	3.78**	1.97	24.00**	10.06*
Gifts	3.36**	.96	21.17**	3.74
Community welfare	2.95**	.45	17.04**	.49
Education	2.93**	1.79	17.31**	8.11
Medical care	2.51*	.80	18.69**	6.51
Vocation	.69	1.01	4.71	1.51
Furnishings and equipment	.42	.37	6.96	3.69
Other	.25	.30	5.74	5.40
Savings (or deficit)	2.50*	1.25	14.74*	4.57
Sub-groups of items				
Food[4]:				
Dairy products	6.71**	9.41**	23.66**	21.83**
Fruit	4.87**	.38	12.69*	3.31
Food away from home	3.49**	3.94**	17.34**	10.09*
Meat	2.59*	2.02	9.34	3.77
Miscellaneous foods	2.01	1.21	15.00*	5.49
Fish	.98	2 43*	4.11	1.91
Vegetables	.73	2.11	6.69	8.80
Grain products	.71	4.76**	3.26	9.71*
Sweets	.20	1.05	3.96	9.94*
Poultry	.20	.99	.30	1.89
Personal care:				
Personal service	4.31**	.70	19.80**	4.71
Personal supplies	3.38**	.75	14.34*	1.49
Household operation:				
Fuel and light[5]	7.26**	1.56	23 25**	6.74

* Indicates that observed figure is "significant," i.e., greater than the value which would be exceeded by chance once in twenty times. For the ratios of variances this value is 2.14 for income and 2.42 for family type. For χ_r^2 it is 12.592 for income and 9.488 for family type. The difference between the values for income and family type is a result of a difference in the number of degrees of freedom on which the respective estimates are based.

** Indicates that observed figure is "highly significant," i.e., greater than the value which would be exceeded but once in a hundred times by chance. For the ratios of variances this value is 2.89 for income and 3.41 for family type. For χ_r^2 it is 15.033 for income and 13.277 for family type.

[1] The figures in this table are based on schedules collected by the Cost of Living Division of the U. S. Bureau of Labor Statistics. These schedules were loaned to the National Resources Committee for special analyses, one of which is presented here.

[2, 3, 4, 5] See next page.

groups: those which would have been exceeded by chance (a) in more than five per cent of random samples, (b) in between five per cent and one per cent of random samples, and (c) in less than one per cent of random samples. An indication of the relative efficiency of the two methods is provided by Table IV, which gives a comparison of the two classifications.

From the entries in the diagonal of Table IV, it is seen that for 45 out of the 56 analyses the two methods lead to similar conclusions. In no case does one of the methods indicate a probability of less than .01 while the other indicates a probability greater than .05.

TABLE IV

COMPARISON OF RESULTS OF ANALYSIS OF VARIANCE AND METHOD OF RANKS

Method of ranks Probability of χ_r^2	Analysis of variance Number of F's with probability			Total
	Greater than .05	Between .05 and .01	Less than .01	
Greater than .05	28	2	0	30
Between .05 and .01	4	1	4	9
Less than .01	0	1	16	17
Total	32	4	20	56

In this example, it seems clear that the loss of information in using the method of ranks is not very great. Indeed, on the basis of Table IV alone, it would be difficult, if not impossible, to choose between the two methods.

A comparison of the ranking of the 28 items by the size of F and by the size of χ_r^2, provides one further indication that the hypotheses tested by the two methods are essentially the same except for the inclusion of the normality assumption in that tested by the analysis of variance. The rank difference correlation between F_i and the corresponding χ_r^2 is .88; between F_f and the corresponding χ_r^2, .66. Both correlations are very large in comparison with their standard error of .19.

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[2] F_i is the ratio of the variance between income levels to the variance within classes. F_f is the ratio of the variance between family types to the variance within classes.

[3] Expenditures include not only money expenses but also the imputed value of gifts in kind. For food, the imputed value of home produced food, and for housing, the imputed value of the use of an owned home, are also included.

[4] The original data give the expenditures on the sub-groups of food only for a seven day period. The remaining ratios in the table are all based on data for annual expenditures.

[5] Fuel and light is, of course, but one of the sub-groups under household operation.

It should be noted that the illustrative comparison just presented is to some extent weighted against the analysis of variance. The distribution of expenditure data departs considerably from normality.[20] In addition, the analysis summarized in Tables I and II indicated that the standard deviation of expenditures is related to the income level; the assumption of uniform variance is, therefore, not justified. However, the body of data analyzed represents no more extreme a departure from the assumptions of normality and uniform variance than is frequently met with.

THE RELATION BETWEEN THE DISTRIBUTION OF χ_r^2 AND χ^2

The statement was made above without proof that χ_r^2 tends to be distributed as χ^2 with $p-1$ degrees of freedom. This statement requires justification.

It is well known that the sum of the squares of m independent observations drawn from a normal universe with unit variance and zero mean is distributed according to the χ^2 distribution with m degrees of freedom. In the present instance, when the number of rows is not too small, the mean ranks can be treated as observations from a normal universe with a true mean $\frac{1}{2}(p+1)$. However, only $p-1$ of the p mean ranks are independent, since the sum of the p mean ranks must equal $\frac{1}{2}p(p+1)$. If $(p-1)$ of them were selected at random, the sum of the squared deviations from the true mean of $\frac{1}{2}(p+1)$ would seem to be distributed as χ^2. However, to discard one of the mean ranks would neglect some of the information; in addition, there is no criterion for deciding which to discard. Instead we can compute the mean squared deviation and multiply it by the number of degrees of freedom, $(p-1)$. This gives[21]

$$\frac{p-1}{p}\sum_{j=1}^{p}(\bar{r}_j-\rho)^2$$

as the numerator of χ_r^2. The denominator must be σ^2, the variance of $\bar{r}$.

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[20] On the question of the effect of departure from normality on the analysis of variance, see Egon S. Pearson, "The Analysis of Variance in Cases of Non-normal Variation," *Biometrika*, Vol. 23, 1931, and T. Eden and F. Yates, "On the Validity of Fisher's *z* Test When Applied to an Actual Example of Non-Normal Data," *Journal of Agricultural Science*, Vol. 23, 1933. The conclusion of both papers is that moderate departure from normality does not seriously affect the analysis of variance.

[21] By analogy with χ^2 as ordinarily defined, the multiplier $(p-1)/p$ seems unnecessary. The difference is this. In the ordinary case we have a sum of squares *artificially lessened* because the deviations are computed from the observed *rather than* the true mean. Here, the observed mean is, of necessity, equal to the true mean. We thus have the sum of p squared deviations from the *true* mean, one of these, however, being essentially a duplication. This is evident when there are only two columns and the two deviations must be equal in absolute value; it is less obvious when there are more than two columns and the duplication is, as it were, spread among all of the deviations. A rigorous demonstration that $(p-1)/p$ is the multiplier needed to correct for this duplication is provided by the proof in the mathematical appendix that the χ_r^2 distribution approaches that of χ^2.

This statement, of course, is not a rigorous proof that the distribution of χ_r^2 approaches the distribution of χ^2 as n increases. A rigorous proof has, however, been provided by Dr. S. S. Wilks and is reproduced in the mathematical appendix.

In addition, the exact values of the first three moments of χ_r^2 have been derived.[22] The mean value is $p-1$; the variance, $2\,(p-1)\,(n-1)/n$; and the third moment about the mean, $8\,(p-1)(n-1)(n-2)/n^2$. The corresponding values for the χ^2 distribution with $p-1$ degrees of freedom are $p-1$, $2(p-1)$, and $8(p-1)$, respectively. It follows that χ_r^2 and χ^2 always have the same mean value, and that the variance and

TABLE V

EXACT DISTRIBUTION OF χ_r^2 FOR TABLES WITH FROM 2 TO 9 SETS OF THREE RANKS

($p=3$; $n=2, 3, 4, 5, 6, 7, 8, 9$)

P is the probability of obtaining a value of χ_r^2 as great as or greater than the corresponding value of χ_r^2

$n=2$

χ_r^2	P
0	1.000
1	.833
3	.500
4	.167

$n=3$

χ_r^2	P
0.000	1.000
0.667	.944
2.000	.528
2.667	.361
4.667	.194
6.000	.028

$n=4$

χ_r^2	P
0.0	1.000
0.5	.931
1.5	.653
2.0	.431
3.5	.273
4.5	.125
6.0	.069
6.5	.042
8.0	.0046

$n=5$

χ_r^2	P
0.0	1.000
0.4	.954
1.2	.691
1.6	.522
2.8	.367
3.6	.182
4.8	.124
5.2	.093
6.4	.039
7.6	.024
8.4	.0085
10.0	.00077

$n=6$

χ_r^2	P
0.00	1.000
0.33	.956
1.00	.740
1.33	.570
2.33	.430
3.00	.252
4.00	.184
4.33	.142
5.33	.072
6.33	.052
7.00	.029
8.33	.012
9.00	.0081
9.33	.0055
10.33	.0017
12.00	.00013

$n=7$

χ_r^2	P
0.000	1.000
0.286	.964
0.857	.768
1.143	.620
2.000	.486
2.571	.305
3.429	.237
3.714	.192
4.571	.112
5.429	.085
6.000	.052
7.143	.027
7.714	.021
8.000	.016
8.857	.0084
10.286	.0036
10.571	.0027
11.143	.0012
12.286	.00032
14.000	.000021

$n=8$

χ_r^2	P
0.00	1.000
0.25	.967
0.75	.794
1.00	.654
1.75	.531
2.25	.355
3.00	.285
3.25	.236
4.00	.149
4.75	.120
5.25	.079
6.25	.047
6.75	.038
7.00	.030
7.75	.018
9.00	.0099
9.25	.0080
9.75	.0048
10.75	.0024
12.00	.0011
12.25	.00086
13.00	.00026
14.25	.000061
16.00	.0000036

$n=9$

χ_r^2	P
0.000	1.000
0.222	.971
0.667	.814
0.889	.865
1.556	.569
2.000	.398
2.667	.328
2.889	.278
3.556	.187
4.222	.154
4.667	.107
5.556	.069
6.000	.057
6.222	.048
6.889	.031
8.000	.019
8.222	.016
8.667	.010
9.556	.0060
10.667	.0035
10.889	.0029
11.556	.0013
12.667	.00066
13.556	.00035
14.000	.00020
14.222	.000097
14.889	.000054
16.222	.000011
18.000	.0000006

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[22] I am indebted to Mr. William C. Shelton for the derivation of the mean value and for suggesting the method of deriving the other moments.

third moment of χ_r^2 approach the variance and third moment of χ^2 as n increases.

For the special case of $p=3$, the exact distribution of χ_r^2 has been derived for n from 2 to 9; and for $p=4$, for n equal to 2, 3 and 4.[23] Table V gives the distributions for $p=3$, and Table VI for $p=4$. These distributions give some empirical indication of how rapidly the χ_r^2 distribution approaches the χ^2 distribution; in addition, they can be used to make exact tests for small values of n and p.

TABLE VI

EXACT DISTRIBUTION OF χ_r^2 FOR TABLES WITH FROM 2 TO 4 SETS OF FOUR RANKS

($p=4$; $n=2, 3, 4$)

P is the probability of obtaining a value of χ_r^2 as great as or greater than the corresponding value of χ_r^2.

$n=2$		$n=3$		$n=4$			
χ_r^2	P	χ_r^2	P	χ_r^2	P	χ_r^2	P
0.0	1.000	0.2	1.000	0.0	1.000	5.7	.141
0.6	.958	0.6	.958	0.3	.992	6.0	.105
1.2	.834	1.0	.910	0.6	.928	6.3	.094
1.8	.792	1.8	.727	0.9	.900	6.6	.077
2.4	.625	2.2	.608	1.2	.800	6.9	.068
3.0	.542	2.6	.524	1.5	.754	7.2	.054
3.6	.458	3.4	.446	1.8	.677	7.5	.052
4.2	.375	3.8	.342	2.1	.649	7.8	.036
4.8	.208	4.2	.300	2.4	.524	8.1	.033
5.4	.167	5.0	.207	2.7	.508	8.4	.019
6.0	.042	5.4	.175	3.0	.432	8.7	.014
		5.8	.148	3.3	.389	9.3	.012
		6.6	.075	3.6	.355	9.6	.0069
		7.0	.054	3.9	.324	9.9	.0062
		7.4	.033	4.5	.242	10.2	.0027
		8.2	.017	4.8	.200	10.8	.0016
		9.0	.0017	5.1	.190	11.1	.00094
				5.4	.158	12.0	.000072

The tables show that if we adopt .01 as a level of significance, then for $p=3$, it is impossible to obtain a significant value for n less than 4, and for $n=4$ only perfect consistency will yield a significant value; for $n=5$, two values will satisfy the criterion and for $n=6$, four values. If .05 is adopted as a level of significance, only perfect consistency is significant for $n=3$, while 2 values are significant for $n=4$, and four values for $n=5$.

For $p=4$, the .01 criterion cannot be satisfied for $n=2$, is satisfied by perfect consistency for $n=3$, and by 6 values for $n=4$. The .05

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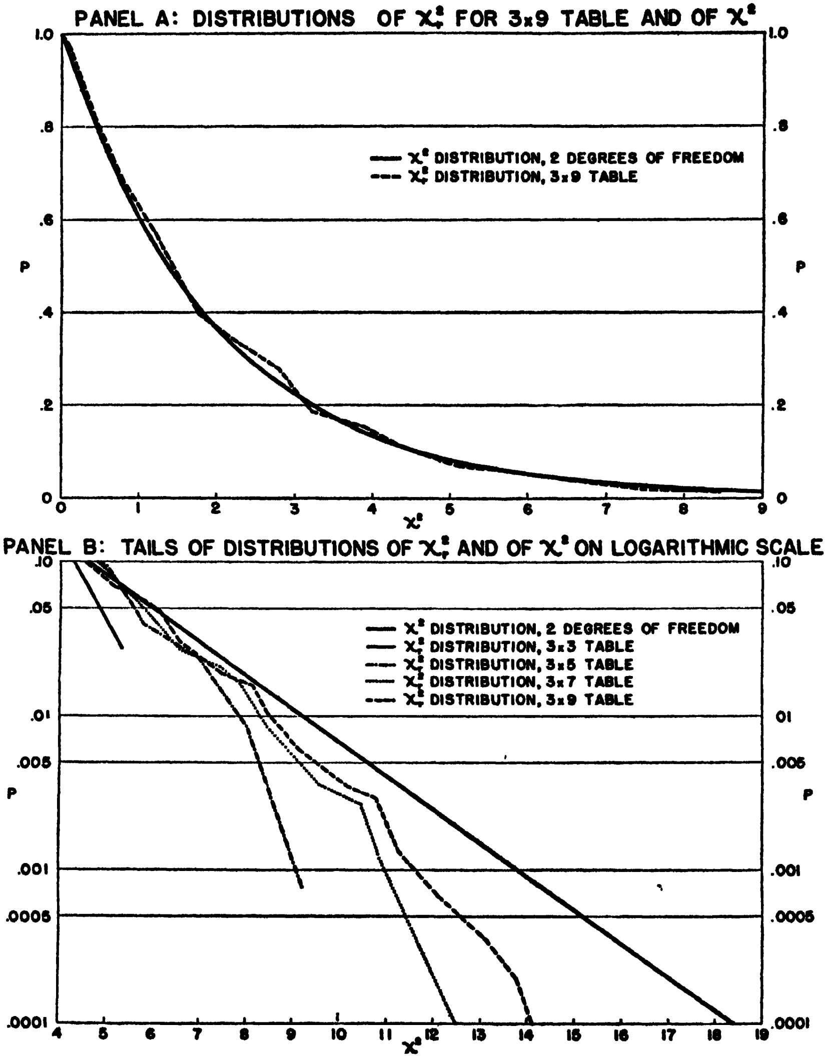
[23] These distributions were derived by the rather laborious process of building up the distribution for each value of n from the distribution for the next smaller value. The labor involved increases greatly as n increases, and even more rapidly as p increases.

criterion is satisfied by one value for $n=2$, three values for $n=3$, and 11 values for $n=4$.

CHART 1

COMPARISON OF DISTRIBUTIONS OF χ_r^2 AND χ^2 FOR TWO DEGREES OF FREEDOM



The comparison of the χ_r^2 distribution with the χ^2 distribution is shown in Chart 1 for $p=3$ and in Chart 2 for $p=4$. In making this comparison it is necessary to allow for the discontinuity of the χ_r^2 distribution. Only a discrete number of finite values of χ_r^2 are possible while χ^2 is continuous. The probability associated with any χ_r^2 in Tables V and VI must thus be considered as corresponding to a value of χ^2 intermediate between that value of χ_r^2 and the immediately preceding value. This intermediate value has been arbitrarily chosen as halfway between the two values of χ_r^2. It is these intermediate values which form the abscissas of the points plotted in the charts.

Panel A of Chart 1 compares the χ_r^2 distribution for a 3×9 table with the χ^2 distribution for 2 degrees of freedom. For convenience, the distributions have been compared in cumulative form. The ordinate gives the probability of securing a value of χ^2 or χ_r^2 as great as or greater than the abscissa. The solid line gives the χ^2 distribution, the dotted line, the χ_r^2 distribution. The agreement between the two distributions is very close. The cumulative curve for the χ_r^2 distribution tends to be somewhat above that for the χ^2 distribution for low values of χ_r^2 and below it for high values. This is to be expected since χ_r^2 must be less than a fixed finite value (that corresponding to perfect consistency) while χ^2 is not so limited.

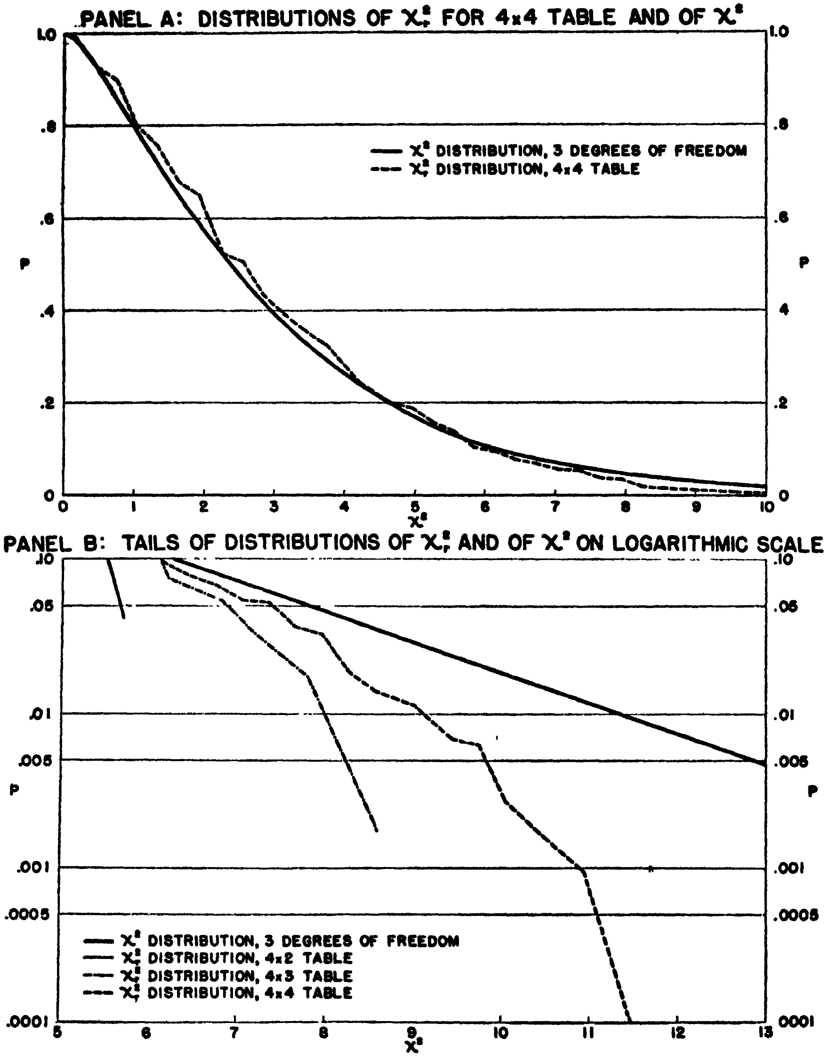
In utilizing tests of significance, it is the small values of P, i.e., one of the tails of the distribution, with which we are ordinarily concerned. In order to bring out more clearly the behavior of this part of the χ_r^2 distribution, a logarithmic scale is used for the probability in Panel B of Chart 1. This panel gives the cumulative distribution of χ_r^2 to the right of $P=.10$ for $p=3$, and $n=3, 5, 7, 9$; as well as the corresponding portion of the χ^2 distribution. The chart shows the tendency of this portion of the χ_r^2 curve to be below the χ^2 curve. It also clearly indicates the tendency for the χ_r^2 distribution to approach the χ^2 distribution and suggests that it does so fairly rapidly.

Panels A and B of Chart 2 are similar to the corresponding panels of Chart 1, but relate to $p=4$. Panel A compares the χ_r^2 distribution for a 4×4 table with the χ^2 distribution for three degrees of freedom. The agreement is good, although, because of the smaller value of n, the discrepancies are somewhat greater than in Panel A of Chart 1. It indicates the same consistent tendency for the χ_r^2 distribution to be above the χ^2 distribution for small values of χ_r^2 and below it for large values. Panel B gives the portion of the cumulative distribution of χ_r^2 to the right of $p=.10$, for $p=4$ and $n=2, 3, 4$, as well as the corresponding portion of the χ^2 distribution. Once again the vertical scale is logarithmic. The tendency for the χ_r^2 distribution to approach the χ^2 distribution very rapidly as n increases, is plain.

The tendency for the values of χ_r^2 adjusted for discontinuity to be less than χ^2 for small probabilities suggests that any errors resulting from using the χ^2 distribution as an approximation to the χ_r^2 distribution are likely to be in the proper direction—that is, the significance of

CHART 2

COMPARISON OF DISTRIBUTIONS OF χ_r^2 AND χ^2 FOR THREE DEGREES OF FREEDOM



PANEL A: DISTRIBUTIONS OF χ_r^2 FOR 4x4 TABLE AND OF χ^2

PANEL B: TAILS OF DISTRIBUTIONS OF χ_r^2 AND OF χ^2 ON LOGARITHMIC SCALE results will be understated rather than exaggerated. This tendency toward under-statement is compensated—indeed, in some cases over-compensated—by the fact that the values of χ_r^2 which can be observed (i.e., the values of χ_r^2 not adjusted for discontinuity) are always greater than the adjusted values. This factor is of minor significance, however, since the number of possible values of χ_r^2 increases very rapidly—and hence the interval between them decreases very rapidly—as either p or n increases. Even for p and n both as small as 4, the difference between the adjusted and unadjusted values of χ_r^2 is, for practical purposes, negligible. It is .15 in all but four cases, .3 in three of these, and 45 in the remaining one.

A comparison of the χ^2 and χ_r^2 distributions at the critical points sheds further light on this problem. For $p=3$ the value of χ^2 corresponding to $P=.05$ is 5.991. From Table V, the nearest value which χ_r^2 can have for $p=3$, $n=9$ is 6, and this has a probability of .057 associated with it. Thus, by using the χ^2 distribution we should be led to overestimate slightly the significance of a value of $\chi_r^2=6$. The next higher value of χ_r^2 is 6.22, and its significance we should estimate properly, since the probability associated with it is .048. The value of χ^2 corresponding to $P=.01$ is 9.21. From Table V, the nearest values which χ_r^2 can have are 8.67, with a probability of .0103, and 9.55 with a probability of .0060. In this case, the use of the χ^2 distribution would yield the correct results; 8.66 would be attributed a probability greater than .01 and 9.55 one less than .01.

For $p=4$, the value of χ^2 corresponding to $P=.05$ is 7.815. The nearest values of χ_r^2 for $p=4$ and $n=4$, as given in Table VI, are 7.5 with a probability of .052, and 7.8 with a probability of .036. The .01 value of χ^2 is 11.341. From the table, 9.3 has a probability of .012, 9.6 of .0069, and 11.1 of .00094. Here, the use of χ^2 would in each case understate the significance of χ_r^2.

While no definitive conclusions can be drawn from these comparisons they suggest that for $p=3$, the use of the χ^2 distribution is likely to give sufficiently accurate results for n greater than 9; while for $p=4$, the use of the χ^2 distribution is likely to understate the significance of large values of χ_r^2 unless n is somewhat larger than 4. In view of the apparent rapidity with which the χ_r^2 distribution approaches the χ^2 distribution when $p=4$, it seems reasonable that for n equal to or greater than 6, the χ^2 distribution will give sufficiently accurate results. For p greater than 4 it is more difficult to make any general statement; but it seems safe to say that the χ^2 distribution will give fairly accurate results for n equal to or greater than 6.[24] A procedure that seems applicable when p is quite large and n less than 6 is discussed below.

RELATION BETWEEN χ_r^2 AND THE RANK DIFFERENCE CORRELATION

When only two sets of ranks are available, the appropriate measure of relationship is the rank difference correlation coefficient, r'. This coefficient is computed by the usual product-moment formula with the ranks serving as the variables, or by the equivalent, but more convenient, formula

$$r' = 1 - \frac{6 \Sigma d^2}{p^3 - p},$$

where d is the difference between two paired values, and p, as above, is the number of pairs of ranks.[25]

For $n=2$, χ_r^2 uses the same data as the rank difference correlation and is designed to test the same hypothesis. The two are, therefore, essentially equivalent. It is shown in the mathematical appendix that the relation between them is

$$\chi_r^2 = (p - 1)(1 + r') .$$

For $n=2$ testing the significance of r' is thus equivalent to testing the significance of χ_r^2.

Under the hypothesis of homogeneity, the mean value of r' is zero, and its variance, $1/(p-1)$.[26] It follows from the last equation that, for $n=2$, both the mean value and variance of χ_r^2 are $(p-1)$. These results agree, of course, with the more general formulae given above.

THE APPROACH TO NORMALITY

Hotelling and Pabst have shown that r' tends to become normally distributed as p increases. It follows that for $n=2$, χ_r^2 tends also to become normally distributed as p increases.

When n is large the distribution of χ_r^2 approaches that of χ^2 and the latter approaches normality as the number of degrees of freedom increases.

Since, for the smallest value of n as well as for large values, the distribution of χ_r^2 tends to normality as p increases, it seems reasonable to assume that for intermediate values of n it behaves similarly. Assuming this to be the case, then for small values of n and large values of p the significance of χ_r^2 can be tested by considering

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[24] It is worth recalling that the rapidity with which the variance of the χ_r^2 distribution approaches the variance of the χ^2 distribution depends solely on n and not at all on p. On the other hand, the number of distinct values of χ_r^2 depends on both p and n.

[25] This is the usual notation except that the number of pairs of ranks is ordinarily designated as n. The present notation is used in order to preserve consistency with the preceding analysis.

[26] Hotelling and Pabst, *op. cit.*, p. 36.

$$\frac{\chi_r^2 - (p - 1)}{2\frac{n - 1}{n}(p - 1)}$$

as a normally distributed variate with zero mean and unit standard deviation.

Further study is clearly needed on this point, both in order to obtain a rigorous proof that for small values of n the χ_r^2 distribution tends to normality as p increases, and also to determine the rapidity with which it approaches normality.

CONCLUSION

The method of ranks is a method which can be applied to data classified by two (or more) criteria to determine whether the factors used as criteria of classification have a significant influence on the variate classified. Stated differently, the method tests the hypothesis that the values of the variate corresponding to each subdivision by one of the factors are homogeneous, i.e., from the same universe. The method uses solely information on "order" and makes no use of the quantitative values of the variate as such. For this reason no assumption need be made as to the nature of the underlying universe or as to whether the different sets of values come from similar universes. The method is thus applicable to a wide class of problems to which the analysis of variance, designed to test a similar hypothesis, cannot validly be applied.

The basic step in the application of the method of ranks is the computation of a statistic, χ_r^2, from a table of ranks. The sampling distribution of this statistic approaches the χ^2 distribution as the number of sets of ranks increases. When the number of sets of ranks is moderately large (say greater than 5 for four or more ranks) the significance of χ_r^2 can be tested by reference to the available χ^2 tables. When the number of ranks in each set is 3, and the number of sets 9 or less, or when the number of ranks in each set is 4, and the number of sets 4 or less, the significance of χ_r^2 can be tested by reference to the exact tables given above. When, however, both the number of ranks and the number of sets of ranks are very small, it is impossible to obtain significant results.

When the number of ranks is large, but the number of sets of ranks small, there is reason to suppose—though no rigorous proof is available—that χ_r^2 is normally distributed about a mean of $p-1$ and with a variance of $2(p-1)\ (n-1)/n$, where p is the number of ranks and n the number of sets of ranks. In such cases, then, the significance of χ_r^2 can be tested by reference to tables of the normal curve.

The theoretical discussion of the efficiency of the method of ranks relative to the analysis of variance indicates that in situations when the latter method can validly be applied and when the number of sets of ranks is large the maximum loss of information through using the analysis of ranks is 36 per cent. The minimum loss is probably 9 per cent. The amount of information lost appears to be greatest when there are only two ranks in each set, and decreases as the number of ranks increases.

The application of the two methods to the same body of data provides further evidence as to their relative efficiency. The data employed were classified into five groups by one of the factors and into seven by the other. The results suggested that in this instance the loss of information through using the method of ranks was not very great, that both methods tended to yield the same result.

The method of ranks requires less than one-fourth as much time as the analysis of variance. In the light of the conclusions just stated concerning their relative efficiency, this suggests that even though the assumptions necessary for the latter method are known to be satisfied, if the problem of computation is a serious one, the method of ranks might profitably be used as an alternative to the analysis of variance or, at least, as a preliminary method to suggest fruitful hypotheses which might then be more accurately tested by the analysis of variance.

MATHEMATICAL APPENDIX

1. *Proof that the χ_r^2 distribution approaches the χ^2 distribution as* n *increases.*[27]

Let r_{ij} = the rank in the i-th row and j-th column, $(i=1, \cdots, n; j=1, \cdots, p)$

$$r'_{ij} = r_{ij} - \tfrac{1}{2}(p+1) \tag{1}$$

and

$$\bar{r}_j' = \frac{1}{n}\sum_{i=1}^{n} r'_{ij}\,. \tag{2}$$

The characteristic function of the quantities $\bar{r}_j'$ $(j=1, \cdots, p)$ is given by

$$\phi = E\left(\exp i\sum_{j=1}^{p-1} \theta_j \bar{r}_j'\right) \tag{3}$$

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[27] This proof is adapted from one given by Dr. S. S. Wilks in a letter to the author.

where E stands for expected value. Only $p-1$ of the $\bar{r}'_j$'s are included because $\bar{r}_p'$ is expressible in terms of $\bar{r}_1', \cdots, \bar{r}'_{p-1}$. This in turn follows from the fact that, for each value of i, r_{ij} takes all the values from 1 to p as j varies. Substituting from (2) into (3) we have

$$\phi = E\left(\exp \frac{i}{n} \sum_{i=1}^{n} \sum_{j=1}^{p-1} \theta_j r'_{ij}\right) . \tag{4}$$

Since the set of ranks in each row is independent of the set of ranks in any other row

$$\phi = \left[E\left(\exp \frac{i}{n} \sum_{j=1}^{p-1} \theta_j r_j'\right)\right]^n \tag{5}$$

where r_j' stands for any of the sets of r'_{ij}. Expanding,

$$\phi = \left\{E\left[1 + \frac{i}{n} \sum_{j=1}^{p-1} \theta_j r_j' + \frac{i^2}{2n^2}\left(\sum_{j=1}^{p-1} \theta_j r_j'\right)^2 + \frac{1}{n^3} R'\right]\right\}^n \tag{6}$$

or

$$\begin{aligned} \phi = \Bigg\{E\Bigg[1 &+ \frac{i}{n} \sum_{j=1}^{p-1} \theta_j r_j' \\ &+ \frac{i^2}{2n^2}\left(\sum_{j=1}^{p-1} \theta_j^2 r_j'^2 + 2\sum_{j=1}^{p-2} \sum_{j'=j+1}^{p-1} \theta_j \theta_{j'} r_j' r'_{j'}\right) + \frac{1}{n^3} R'\Bigg]\Bigg\}^n . \end{aligned} \tag{7}$$

But since r_j' takes all of the p values differing by unity from $-\frac{1}{2}(p-1)$ to $\frac{1}{2}(p-1)$ with equal probability

$$Er_j' = 0 , \tag{8}$$

$$Er_j'^2 = \frac{1}{p} \sum_{r_j'=-(p-1)/2}^{(p-1)/2} r_j'^2 = (p^2 - 1)/12 . \tag{9}$$

Further

$$Er_j' r'_{j'} = -(p + 1)/12 \tag{10}$$

since

$$\left(\sum_{r_j'=-(p-1)/2}^{(p-1)/2} r_j'\right)^2 = \sum_{r_j'=-(p-1)/2}^{(p-1)/2} r_j'^2 + 2 \sum_{r_j'=-(p-1)/2}^{(p-3)/2} \sum_{r'_{j'}=r_j'+1}^{(p-1)/2} r_j' r'_{j'} = 0 \tag{11}$$

and hence

$$p(p-1)Er_j' r'_{j'} = -pEr_j'^2 = -p(p^2 - 1)/12 . \tag{12}$$

Using these results in (7) gives

$$(13)\qquad \phi=\left\{1-\frac{1}{2n^2}\left[\frac{p^2-1}{12}\sum_{j=1}^{p-1}\theta_j^2-2\frac{p+1}{12}\sum_{j=1}^{p-2}\sum_{j'=j+1}^{p-1}\theta_j\theta_{j'}\right]+\frac{1}{n^3}R\right\}^n$$

where R is a bounded function of $p, r_1', \cdots, r'_{p-1}$ for $n=1, 2, 3, \cdots$.

Allowing n to approach infinity, we have

$$(14)\qquad \phi \cong \exp -\frac{p^2-1}{24n}\left(\sum_{j=1}^{p-1}\theta_j^2-\frac{2}{p-1}\sum_{j=1}^{p-2}\sum_{j'=j+1}^{p-1}\theta_j\theta_{j'}\right).$$

This, however, is the characteristic function for a multivariate normal distribution. It follows that $\bar{r}_1', \cdots, \bar{r}'_{p-1}$ are asymptotically normally distributed with a matrix of variances and covariances given by the matrix of the quadratic in $\theta_1, \cdots, \theta_{p-1}$

Taking the reciprocal of the matrix of the θ's and associating it with the $\bar{r}_j'$'s we have as the distribution function of the $\bar{r}_j'$'s:

$$(15)\qquad C\exp\left\{-\frac{1}{2}\,\frac{12n}{p(p+1)}\left(2\sum_{j=1}^{p-1}\bar{r}_j'^2+2\sum_{j=1}^{p-2}\sum_{j'=j+1}^{p-1}\bar{r}_j'\bar{r}'_{j'}\right)\right\} d\bar{r}_1'd\bar{r}_2'\cdots d\bar{r}'_{p-1}$$

where C is a constant

Since $\sum_{j=1}^{p}\bar{r}_j'=0$ it follows that $\bar{r}_p'=-\sum_{j=1}^{p-1}\bar{r}_j'$ and hence

$$(16)\qquad \bar{r}_p'^2=\left(\sum_{j=1}^{p-1}\bar{r}_j'\right)^2=\sum_{j=1}^{p-1}\bar{r}_j'^2+2\sum_{j=1}^{p-2}\sum_{j'=j+1}^{p-1}\bar{r}_j'\bar{r}'_{j'}.$$

Substituting (16) in the exponent of (15) we have, finally, for the distribution function

$$(17)\qquad \begin{aligned} &C\exp\left\{-\frac{1}{2}\,\frac{12n}{p(p+1)}\sum_{j=1}^{p}\bar{r}_j'^2\right\}d\bar{r}_1'd\bar{r}_2'\cdots d\bar{r}'_{p-1}\\ &= C\exp\left(-\tfrac{1}{2}\chi_r^2\right)d\bar{r}_1'd\bar{r}_2'\cdots d\bar{r}'_{p-1}, \end{aligned}$$

by the definition of χ_r^2. It follows that for n large χ_r^2 is distributed like χ^2 with $p-1$ degrees of freedom.

2. Derivation of the exact moments[28] *of* χ_r^2.

By definition

$$(18)\qquad \chi_r^2=\frac{12n}{p(p+1)}\sum_{j=1}^{p}\bar{r}_j'^2=\frac{12n}{p(p+1)}\,\frac{1}{n^2}\sum_{j=1}^{p}\left(\sum_{i=1}^{n}r'_{ij}\right)^2.$$

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[28] The derivation of the mean value of χ_r^2 is adapted from one communicated to the author by Mr. William C. Shelton, who also suggested the method used for deriving the other moments. The method employed is essentially that developed by J. Splawa-Neyman, "Contributions to the Theory of Small Samples Drawn from a Finite Population," *Biometrika*, Vol. 17, 1925, pages 472–79.

Expanding, replacing $\sum_{j=1}^{p}\sum_{i=1}^{n} r'^{2}_{ij}$ by its value $np\ (p^2-1)/12$, and rearranging the order of the summation signs we have

$$(19)\qquad \chi_r^2 = (p-1) + \frac{24}{p(p+1)n}\sum_{i=1}^{n-1}\ \sum_{i'=i+1}^{n}\ \sum_{j=1}^{p} r'_{ij}r'_{i'j}\ .$$

Taking the expected value of both sides gives

$$(20)\qquad E\chi_r^2 = (p-1) + \frac{24}{p(p+1)n}\sum_{i=1}^{n-1}\ \sum_{i'=i+1}^{n}\ \sum_{j=1}^{p} E(r'_{ij}r'_{i'j})\ .$$

But since one row of the table of ranks is entirely independent of any other row, $Er'_{ij}\ r'_{i'j} = Er'_{ij}\ Er'_{i'j} = 0$.

$$(21)\qquad \therefore\qquad E\chi_r^2 = p-1\ .$$

From (19) and (21)

$$(22)\qquad \chi_r^2 - E\chi_r^2 = \frac{24}{p(p+1)n}\sum_{i=1}^{n-1}\ \sum_{i'=i+1}^{n}\ \sum_{j=1}^{p} r'_{ij}r'_{i'j}\ .$$

The k-th moment of χ_r^2 about its mean value can therefore be obtained by evaluating the expected value of the k-th power of the right hand side of (22).

To determine the variance of χ_r^2 first note that $\sum_{j=1}^{p} r'_{ij}\ r'_{i'j}$ is independent of $\sum_{j=1}^{p} r'_{ij}\ r'_{i''j}$. This can be proved by multiplying the two expressions. The expected value of the resultant product is easily shown to be zero. Likewise, $\sum_{j=1}^{p} r''_{ij}\ r'_{i'j}$ is independent of $\sum_{j=1}^{p} r'_{i''j}\ r'_{i'''j}$. It follows that

$$(23)\quad E\left[\sum_{i=1}^{n-1}\ \sum_{i'=i+1}^{n}\ \sum_{j=1}^{p} r'_{ij}\ r'_{i'j}\right]^2 = \sum_{i=1}^{n-1}\ \sum_{i'=i+1}^{n} E\left(\sum_{j=1}^{p} r'_{ij}\ r'_{i'j}\right)^2 .$$

But

$$(24)\quad \begin{aligned} E\left(\sum_{j=1}^{p} r'_{ij}r'_{i'j}\right)^2 &= E\left(\sum_{j=1}^{p} r'^{2}_{ij}r'^{2}_{i'j} + 2\sum_{j=1}^{p-1}\ \sum_{j'=j+1}^{p} r'_{ij}r'_{i'j}r'_{ij'}r'_{i'j'}\right) \\ &= \sum_{j=1}^{p} Er'^{2}_{ij}Er'^{2}_{i'j} + 2\sum_{j=1}^{p-1}\ \sum_{j'=j+1}^{p} E(r'_{ij}r'_{ij'})E(r'_{i'j}r'_{i'j'})\ . \end{aligned}$$

Substituting (9) and (10) into (24) and the resultant expression into (23) gives

$$E\left[\sum_{i=1}^{n-1}\sum_{i'=i+1}^{n}\sum_{j=1}^{p} r'_{ij}r'_{i'j}\right]^2 = \frac{n(n-1)}{2}\,\frac{p^2(p-1)(p+1)^2}{12^2}\,. \tag{25}$$

Multiplying this by $[p(p+1)n/24]^{-2}$ gives, finally, the variance of χ_r^2

$$\sigma^2 = 2\,\frac{n-1}{n}\,(p-1)\,. \tag{26}$$

To determine the third moment of χ_r^2 about its mean note that the only term in the expansion of

$$\left[\sum_{i=1}^{n-1}\sum_{i'=i+1}^{n}\sum_{j=1}^{p} r'_{ij}r'_{i'j}\right]^3$$

whose expected value is not zero is

$$6\sum_{i=1}^{n-2}\sum_{i'=i+1}^{n-1}\sum_{i''=i'+1}^{n}\left[\sum_{j=1}^{p} r'_{ij}r'_{i'j}\sum_{j=1}^{p} r'_{ij}r'_{i''j}\sum_{j=1}^{p} r'_{i'j}r'_{i''j}\right]. \tag{27}$$

Expanding the expression in brackets gives

$$\begin{aligned}&\sum_{j=1}^{p} r'^{\,2}_{ij}r'^{\,2}_{i'j}r'^{\,2}_{i''j} + 3\sum_{j=1}^{p-1}\sum_{j'=j+1}^{p} r'^{\,2}_{ij}r'_{i'j}r'_{i''j}r'_{i'j'}r'_{i''j'}\\ &\qquad + 6\sum_{j=1}^{p-2}\sum_{j'=j+1}^{p-1}\sum_{j''=j'+1}^{p} r'_{ij}r'_{i'j}r'_{ij'}r'_{i''j'}r'_{i'j''}r'_{i''j''}.\end{aligned} \tag{28}$$

Taking expected values, and substituting from (9) and (10) gives $p^3(p-1)(p+1)^3/12^3$ as the expected value of (28). Substituting this in (27) gives

$$\begin{aligned}&E\left[\sum_{i=1}^{n-1}\sum_{i'=i+1}^{n}\sum_{j=1}^{p} r'_{ij}r'_{i'j}\right]^3\\ &\qquad = \frac{6n(n-1)(n-2)}{1\cdot 2\cdot 3}\,\frac{p^3(p-1)(p+1)^3}{12^3}\,.\end{aligned} \tag{29}$$

Multiplying this by $[p(p+1)n/24]^{-3}$ gives as the third moment of χ_r^3 about its mean

$$\mu_3 = \frac{8(n-1)(n-2)}{n^2}\,(p-1)\,. \tag{30}$$

3. Derivation of relationship between χ_r^2 and rank difference correlation (r′) when n=*2.*

From (19) we have, for $n=2$

$$\chi_r^2 = (p-1) + \frac{12}{p(p+1)} \sum_{j=1}^{p} r'_{1j} r'_{2j}\,. \tag{31}$$

But, using the product moment formula, the rank difference correlation coefficient is defined as[29]

$$r' = \frac{\sum_{j=1}^{p} r'_{1j}\, r'_{2j}}{\sqrt{\sum_{j=1}^{p} r'^{2}_{1j} \sum_{j=1}^{p} r'^{2}_{2j}}} = \frac{12}{p(p^2-1)} \sum_{j=1}^{p} r'_{1j}\, r'_{2j}\,. \tag{32}$$

Substituting in (31) this gives

$$\chi_r^2 = (p-1)(1+r') \tag{33}$$

as the relation between χ_r^2 and the rank difference correlation coefficient.

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[29] The notation used in (32) may be somewhat confusing. The symbol r' which stands for the rank difference correlation coefficient is to be distinguished from r'_{ij} which stands for the deviaton of a rank from its expected value.

SOME ADJUSTMENTS IN CENSUS DATA ON UNEMPLOYMENT

By Don D. Humphrey
Works Progress Administration

Studies of unemployment have usually been concerned with the number of workers unemployed. There are half a dozen current estimates of unemployment, such as those of the American Federation of Labor and the National Industral Conference Board, all of which use the *worker* as the unit of measurement. The family, however, is a significant economic unit to consider in studies of unemployment. If a worker in a multi-worker family loses his job, the burden of support falls upon the other workers who may still be employed, but if the sole worker in a family becomes unemployed the family is deprived of all its earnings. From the relief standpoint, the number of families having no member employed is more significant than the number of workers unemployed. It makes a great difference, for example, whether the two million workers reemployed within the past year were workers from families, some of whose workers already were employed, or were workers from families which had no other members working.

In many unemployment censuses sufficient data have been gathered to determine the extent to which the unemployed workers fall in (a) partially unemployed families or (b) totally unemployed families, but with few exceptions the family data have not been tabulated. The clumsy expression "totally unemployed family" is used here, in the absence of anything better, to mean a family which has one or more workers all of whom are unemployed. "Partially unemployed family" is used to mean a multi-worker family which has one or more workers employed and one or more workers unemployed.

To interpret unemployment in terms of families requires some important adjustments in the census data. The relation between the two series—unemployed workers and families with no member employed—is not constant but varies with changes in unemployment. This functional relationship is also affected by geographical differences in the structure of family worker groups,[1] i.e., the percentage of one- and multi-worker families; consequently, adjustments in the raw data are requisite to interpretation and generalization. It is the character of this adjustment with which these comments are chiefly concerned.

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[1] The expression "family worker group" refers to the *worker* or *group of workers* in a family, and, of course, is not the same thing as "size of family."

The empirical data[2] presented are partly from local censuses published in the *Monthly Labor Review* and partly from special tabulations made by the Works Progress Administration.

It is quite obvious that the specific rates of unemployment for family worker groups are characteristically different. Thus in Bridgeport, Connecticut, a census in 1934 showed that of the one-, two-, three-, and four-or-more-worker families, 21.8, 10.2, 6.4, and 4.5 per cent, respectively, were totally unemployed. Clearly the percentage of all family groups totally unemployed is nothing more than the weighted average of the specific rates for each group. Now this circumstance has an important result in regard to the use of the general rate to measure the functions relating the number of workers unemployed and the number of families totally unemployed. For suppose two communities to have identical specific rates for each family group, but suppose, also, as is the case, that one has twice as high a percentage of multi-worker families as the other. The city with the larger proportion of multi-worker families will, as a consequence, have a lower general rate for families totally unemployed. Because of the different distribution of family groups, communities are bound to have quite different general rates for families totally unemployed, even though, as postulated, the specific rates are identical.

The same problem in vital statistics is handled by the "standardized death-rate."[3] Due to different age distributions, two communities may have different crude death-rates, even though the specific rates for each age are identical. Consequently, crude death-rates are adjusted to allow for differences in the age distribution.

In the case of Bridgeport, the census showed 28 per cent of the workers unemployed and 15 per cent of the families totally unemployed. Only 52 per cent of Bridgeport's families were one-worker families in contrast to 64 per cent in urban United States. If the specific unemployment rates for each family worker group are weighted by the United States distribution, there are not 15.4 but 17.1 per cent of the families totally unemployed. This may be called the standardized rate, which is an abstract or theoretical figure, derived by reweighting the specific rates in a particular city according to the general urban distribution.

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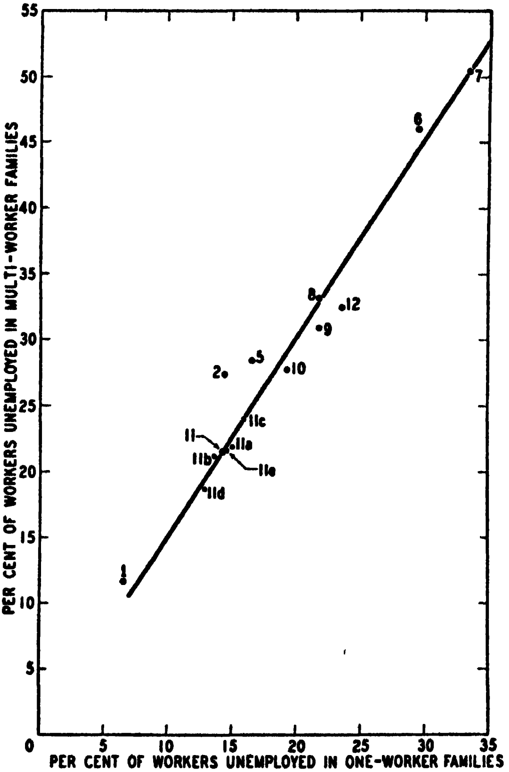
[2] The *Monthly Labor Review*, February 1930, May and June 1932, and May 1935, reports censuses for Philadelphia, Syracuse, Buffalo, and Bridgeport, respectively; a sample study of the policyholders of the Metropolitan Life Insurance Company was reported in the issue of March 1931. Special tabulations (unpublished) have been made of the Philadelphia censuses in 1931, 1932, 1933, and 1936, and of the Michigan census in 1935.

[3] Raymond Pearl, *Introduction to Medical Biometry and Statistics* (2d ed., 1930), ch. IX.

But the matter does not end here, for the corresponding rate of unemployment among workers must be similarly corrected. While it is an obvious fact that among families the specific rates will be characteristically different in one- and multi-worker families, it might be assumed that among workers the rate would be the same in all groups. But such is not the case. In all the studies examined, there is a marked difference in the rate of unemployment between workers in one- and in multi-worker families, the incidence of unemployment being heavily concentrated in the multi-worker groups. In Bridgeport, which is typical, workers in one- and multi-worker families were 21.8 and 30.8 per cent unemployed respectively. Thus, if the specific rates for workers in the one- and multi-worker families are weighted by the United States urban distribution, the standardized average rate of unemployment for all workers is 26.6 (crude rate 28.1).

CHART I

RELATION BETWEEN WORKERS UNEMPLOYED IN ONE- AND IN MULTI-WORKER FAMILIES



It will be observed that, due to the different distribution of family worker groups, the family rate would need to be corrected even if workers in all family groups suffered unemployment at the same rate. The necessity for correcting the worker rate, however, arises solely from the fact that workers in one- and multi-worker families suffer unemployment at different rates.

The relation between workers unemployed in one- and multi-worker families is shown in Chart I and Table I. These data include the years from 1929 to 1936. The range of unemployment is from less than 10 to more than 40 per cent. The straight line has been fitted free-hand and indicates that unemployment among workers in multi-worker families is 50 per cent higher than in one-worker families (within the range indicated).

TABLE I

PERCENTAGE OF WORKERS UNEMPLOYED IN ONE- AND MULTI-WORKER FAMILIES

Number in Chart I	Date	Location	Percentages	
			One-worker families	Multi-worker families
1	1929	Philadelphia	6.6	11.7
2	1930	Metro. Life Ins. Co.	14.5	27.3
*5	1931	Philadelphia	16.7	28.3(e)
6	1932	Philadelphia	29.7	45.9(e)
7	1933	Philadelphia	33.6	50.3
8	1934	Manhattan & Bronx	21.8	33.1(e)
9	1934	Bridgeport	21.8	30.8
10	1934	Dayton	19.4	27.7
11	1935	Michigan aggregate	14.4	21.5
11a		Cities, 40,00 and Over	15.1	21.8
11b		Cities, 3,000 to 40,000	13.7	21.2
11c		Towns and Villages	16.0	24.0
11d		Metropolitan Townships	12.9	18.7
11e		Rural Townships	14.7	21.6
12	1936	Philadelphia	23.7	32.4

(e) Partially estimated.

* Items 3 and 4 are omitted due to lack of detail.

The distribution of family worker groups shown in Table II indicates the basis for the adjustments. The relation between unemployed workers and families totally unemployed is shown in Table III and Chart II with both crude and standardized rates. Note that the horizontal scale in Charts II, III, and IV represents *all* workers. The curve has been fitted free-hand. It is clear from Chart II that the standardized data are more homogeneous, the differences due to the distribution of family groups having been eliminated.

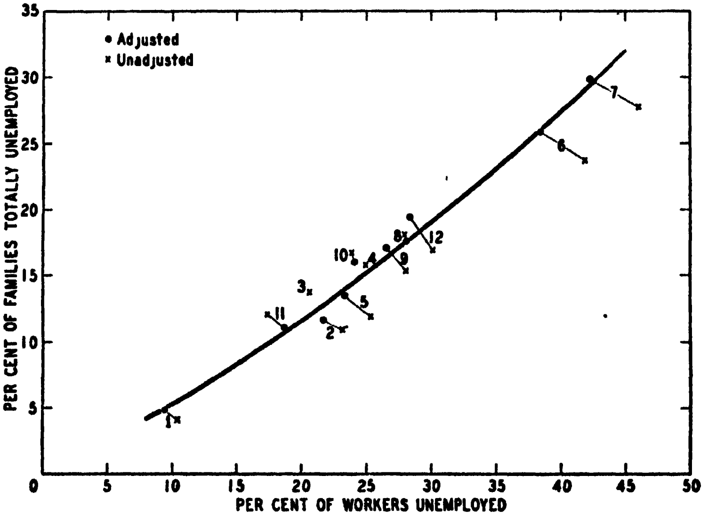
TABLE II

PERCENTAGE DISTRIBUTION OF FAMILY WORKER GROUPS FOR THE UNITED STATES AND SELECTED COMMUNITIES

	Date	All worker families	Families having			
			1 worker	2 workers	3 workers	4 or more workers
U. S. Census, Total	1930	100.0	66.1	22.5	7.6	3.8
Urban		100.0	64.0	23.9	8.2	3.9
Rural Non-Farm		100.0	72.7	19.6	5.5	2.2
Rural Farm		100.0	65.9	21.4	8.0	4.7
Philadelphia	1929	100.0	47.7	30.0	13.2	9.1
Metropolitan Life Ins. Co.	1930	100.0	55.9	26.7	10.5	6.9
Philadelphia	1931	100.0	49.3	27.3	13.8	9.6
Philadelphia	1932	100.0	48.2	26.8	14.6	10.4
Philadelphia	1933	100.0	49.5	26.5	13.7	10.3
Manhattan and Bronx	1934	100.0	67.9	21.7	7.2	3.2
Bridgeport	1934	100.0	52.3	28.2	12.0	7.5
Dayton	1934	100.0	68.3	23.8	5.9	2.0
Michigan, State	1935	100.0	75.7	18.3	4.6	1.4
Cities, 40,000 & Over		100.0	76.6	18.0	4.2	1.2
Cities, 3,000 to 40,000		100.0	76.0	18.6	4.2	1.2
Towns and Villages		100.0	73.6	19.6	5.1	1.7
Metropolitan Townships		100.0	78.1	15.9	4.3	1.7
Rural Townships		100.0	72.3	19.6	6.1	2.0
Philadelphia	1936	100.0	48.5	28.9	13.5	9.1

CHART II

RELATIONSHIP BETWEEN WORKERS UNEMPLOYED AND FAMILIES TOTALLY UNEMPLOYED



In case the proportion of one-worker families was below the standard (i.e., 1930 Census for the urban United States), the correction reduces the average rate of unemployment for all workers and increases the corresponding rate for families totally unemployed. This is due to the heavier weighting of the one-worker families who characteristically, as workers, enjoy a lower rate of unemployment, but who, as families, suffer a much higher rate of total unemployment than do multi-worker families. The reverse is, of course, true when the proportion of one-worker families is above the standard.

TABLE III

RELATION BETWEEN UNEMPLOYED WORKERS AND TOTALLY UNEMPLOYED FAMILIES

Number in Chart II	Date	Location	Percentages			
			Workers		Families	
			unadjusted rate	adjusted rate	unadjusted rate	adjusted rate
1	1929	Philadelphia	10.4	9.4	4.1	4.9
2	1930	Metro. Life Ins. Co.	23.2	21.7	10.9(e)	11.7(e)
3	1931	Syracuse	20.6	*	13.7	*
4	1931	Buffalo	24.9	*	15.8	*
5	1931	Philadelphia	25.3(e)	23.3(e)	11.9	13.5
6	1932	Philadelphia	41.8(e)	38.5(e)	23.6	25.8
7	1933	Philadelphia	46.0	42.3	27.7	29.8
8	1934	Manhattan and Bronx	27.9	28.1(e)	18.1	17.6
9	1934	Bridgeport	28.1	26.6	15.4	17.1
10	1934	Dayton	23.8	24.1	16.7	16.0
11	1935	Michigan Aggregate	17.4	18.7	12.1	11.1
11a		Cities, 40,000 & Over	17.9	19.5	12.9	11.6
11b		Cities, 3,000 to 40,000	16.8	18.8	11.5	10.4
11c		Towns and Villages	19.6	21.1	13.6	13.0
11d		Metropolitan Townships	15.2	16.2	11.0	9.9
11e		Rural Townships	18.0	18.5	11.8	11.4
12	1936	Philadelphia	30.1	28.4	17.0	19.4

* Data were not available in sufficient detail to make the adjustment.

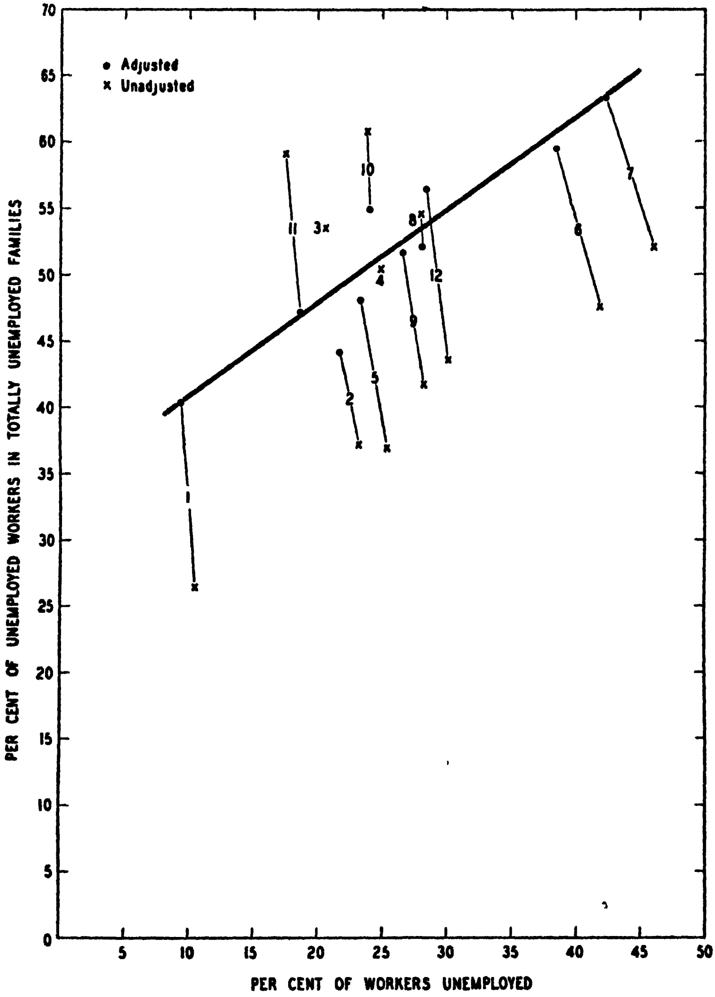
(e) Partially estimated.

Standardization of the rate of unemployment is essential in interpreting census data involving family groups. Consider, for example, the proportion of all unemployed workers who are in (a) totally unemployed families and (b) partially unemployed families. This proportion is in itself a function of the rate of unemployment. The higher the rate of unemployment, the larger the proportion of the unemployed who will be in totally unemployed families. In Chart III, the straight line which has been fitted free-hand shows that from 40 to more than 60 per cent of unemployed workers were in totally unemployed families. The standardized data appear reasonably homogeneous; the dispersion in the crude data, however, is very considerable.

Table IV shows the standardized and unadjusted data for Charts III and IV. When one-worker families are *under*represented, as in Philadelphia, the effect of the adjustment is (a) to reduce the total number of unemployed workers and (b) to raise slightly the number of workers in totally unemployed families, with the result that the ratio of unemployed workers in totally unemployed families to all unemployed workers is increased from 26 to 40 per cent. Vice versa, when one-worker families are *over*represented, as in Michigan, the effect of

CHART III

RELATIONSHIP BETWEEN WORKERS UNEMPLOYED AND PER CENT OF UNEMPLOYED WORKERS IN TOTALLY UNEMPLOYED FAMILIES



the adjustment is (a) to increase the number of unemployed workers and (b) to reduce slightly the workers in totally unemployed families, with the result that the ratio is reduced from 59 to 47 per cent.

The reason the adjusted number of unemployed workers is higher than that given in the Census, when one-worker families are overrepresented, is that the adjustment pushes a larger proportion of the total number of workers into the multi-worker families where the rate of unemployment for workers is higher. Likewise, the number of workers in totally unemployed families is reduced slightly by the adjustment because the number of totally unemployed families is itself reduced slightly (as in Chart II) when the proportion of multi-worker families is increased.

TABLE IV

PER CENT OF UNEMPLOYED WORKERS IN TOTALLY UNEMPLOYED FAMILIES AND AVERAGE NUMBER OF WORKERS PER TOTALLY UNEMPLOYED FAMILY

Item*	Per cent of unemployed workers in totally unemployed families**		Average number of workers per totally totally unemployed family***	
	Unadjusted rate	Adjusted rate	Unadjusted rate	Adjusted rate
1	26.5	40.3	1.283	1.181
2	37.2	44.2	1.353	1.266
3	53.6	—	1.246	—
4	50.4	—	1.262	—
5	36.9	48.1	1.472	1.278
6	47.9	59.5	1.643	1.365
7	52.1	63.4	1.648	1.385
8	54.6	52.1	1.240	1.282
9	41.7	51.7	1.360	1.240
10	60.8	54.9	1.232	1.274
11	59.1	47.4	1.123	1.197
12	43.6	56.4	1.451	1.274

* For identification see Table III.

** Chart III.

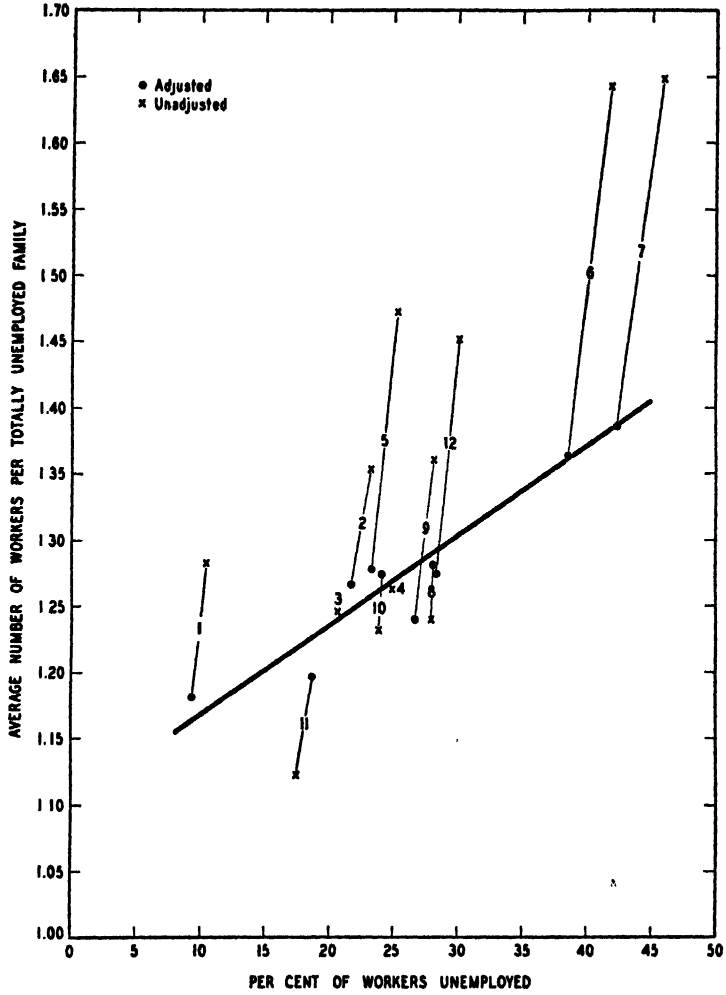
*** Chart IV.

To complete the picture, consider the effect of standardization upon a third relationship, namely, the average number of workers per totally unemployed family. A moment's reflection will show that, due to the presence of multi-worker families, the average number of workers per totally unemployed family changes with the rate of unemployment. Chart IV indicates a rise from 1.17 to 1.38 workers per totally unemployed family as unemployment moves from 10 to 40 per cent.

In Philadelphia (1929), where one-worker families are *under*represented, the correction lowers the number of workers per totally unemployed family from 1.28 to 1.18. In Michigan, where the one-worker families are *over*represented, the correction increases the number of workers per totally unemployed family from 1.12 to 1.20. The reason is that, in the latter case, while both the number of totally unemployed families and the number of workers in them are lowered, the number of workers in totally unemployed families is reduced less than the number of totally unemployed families. This is because the adjustment increases the proportion of multi-worker families, where the

CHART IV

RELATIONSHIP BETWEEN WORKERS UNEMPLOYED AND THE AVERAGE NUMBER OF WORKERS PER TOTALLY UNEMPLOYED FAMILY



characteristic rates for family unemployment are lower but where the number of workers per family is obviously higher.

In case the distribution of family groups has changed since 1930, the standardization should, of course, be altered accordingly. Similarly, if the functional relationships shown in Charts II, III, and IV are wanted for individual cities or states, then the data should be standardized on a basis of the distribution of family groups in that particular community. In this manner these local censuses can be used as a basis for converting the number of unemployed workers into totally and partially unemployed families.

As unemployment grows, (a) the percentage of the unemployed who are in totally unemployed families increases, and (b) the average number of workers per family grows. Rough estimates of the number of families totally unemployed can be easily derived from the functional relationship in either Chart II or Charts III and IV.

To illustrate: assume that there are 7 million unemployed urban family workers with a corresponding labor supply of 28 million.[4] The rate of unemployment, then, is 25 per cent. Reading from Chart III there are 51.5 per cent of the 7 million unemployed, or 3,605,000, in totally unemployed families. According to Chart IV, there are 1.27 workers per totally unemployed family. The result is that 3,605,000 workers divided by 1.27 workers per family gives 2,839,000 totally unemployed families. The remaining 3,395,000 unemployed workers are in partially employed families.

Check this with the results obtained from Chart II. When workers are 25 per cent unemployed, families are 15.4 per cent totally unemployed. An urban labor supply of 28 million multiplied by 0.6495, which is the average number of families per urban worker,[4] gives 18.2 million census families. Of these families, 15.4 per cent, or 2,803,000, are totally unemployed, a negligible difference from the results obtained above.

To estimate the number of totally unemployed families without allowing for the difference indicated in Chart I will result in a serious overestimate. Assuming that workers in *all* family groups are 25 per cent unemployed, there would be not 2,803,000 but 3,276,000 totally unemployed families. This is because a straight rate of 25 per cent for workers in all groups results in 18 instead of 15.4 per cent of the families being totally unemployed.

Similarly, if the number of workers per totally unemployed family (Chart IV) is calculated without allowing for differences in the incidence of unemployment (Chart I), the result is a serious understatement. For at a rate of 25 per cent there would be 1.10 workers per totally unemployed family, whereas the empirical data indicate 1.27.

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[4] This excludes the non-family workers as defined in the 1930 U. S. Census.

Failure to correct the crude data will, obviously, lead to serious error. For example, the Philadelphia data show, again assuming unemployment to be 25 per cent, that less than 40 per cent of the workers were in totally unemployed families (Chart III). If weighted by the Detroit distribution of family groups, however, the adjustment of the Philadelphia specific rates would show more than 60 per cent of the unemployed workers to be in totally unemployed families.

These illustrations have dealt with family unemployment. The necessity for the standardization of census data is not, however, limited to these cases. In order to compare average rates of unemployment, the standardization will often be helpful. If the census shows 25 per cent of the workers in both Philadelphia and Michigan cities to be unemployed, it does not mean quite the same thing. If the rates for each city are "standardized" with regard to the distribution of family groups, then, due to the relationship shown in Chart I, there is a difference of about one-sixth between them.

There are, of course, many other differences, due to age, sex, nativity, and occupation, some of which are related to the multi-worker family differential. Crude data can be standardized for each of these factors also. The family has been emphasized because it appears to be a significant factor which has been neglected.

It scarcely need be added that the only occasion for standardizing the rates of unemployment is when data from one community are to be compared with data from another, or in generalizing from sample studies.

NOTES

INDEX OF MANUFACTURING PRODUCTION DERIVED FROM CENSUS DATA, 1935

By Vladimir S. Kolesnikoff

The index of physical volume of production of manufactures has recently been computed for the year 1935. This index compiled for the years 1914–1925 by E. E. Day and Woodlief Thomas[1] and for 1927–1931 by Miss Aryness Joy[2] has been revised for the years 1919–1933.[3]

The biennial index numbers on a 1919 base compared with the Federal Reserve Board index of manufacturing production are as follows:

Year	Index numbers 1919=100		Per cent change from preceding census year	
	Census	F.R.B.	Census	F.R.B.
1921	79.2	78.8	...	...
1923	122.7	119.5	+54.9	+51.6
1925	128.2	123.8	+ 4.5	+ 3.6
1927	127.9	125.1	− .2	+ 1.1
1929	145.1	141.2	+13.4	+12.9
1931	96.4	94.9	−33.6	−32.8
1933	89.2	89.2	− 7.5	− 6 0
1935	106.1	106.4	+18.9	+19.3

The index numbers for industrial groups and for individual industries are shown in the table on the next page. The index numbers and weights for industrial groups and for individual industries for the years 1919–1933 were given in this Journal for September, 1935.

Further details will be supplied on request.

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[1] Census monograph "The Growth of Manufactures, 1899–1923."

[2] This Journal, Volume 25 (1930), p. 453 and Vol. 29 (1934), p. 305.

[3] This Journal, Volume 30, p. 581.

INDEX NUMBERS OF MANUFACTURING PRODUCTION BASED ON CENSUS DATA, 1935
(1919 = 100; Index for *All Industries* = 106.1; Sum of weights = 1000)

Industry	Index Numbers	Weights
I. FOOD AND KINDRED PRODUCTS	118.3	125
Butter, cheese and milk	150.6	15
Meat packing	94.9	42
Flour	72.4	20
Sugar, beet	164.3	4
Sugar, cane refining	119.6	6
Canned: fruits and vegetables	220.2	21
Canned: fish	143.7	3
Corn syrup, corn oil and starch	136.1	4
Ice, manufactured	116.9	10
II. TEXTILES AND THEIR PRODUCTS	114.4	167
Cotton goods	104.4	67
Knit goods	124.7	32
Silk manufactures	143.5	24
Woolen and worsted goods	108.1	35
Carpets and rugs, wool	113.4	6
Cordage and twine	111.1	3
III. IRON, STEEL AND THEIR PRODUCTS	92.1	233
Blast furnaces	69.3	19
Steel works and rolling mills	94.5	214
IV. LUMBER AND ITS REMANUFACTURES	57.2	66
Lumber and timber products	57.2	66
V. LEATHER AND ITS FINISHED PRODUCTS	106.0	37
Leather, tanned, curried and finished	90.1	12
Boots and shoes	114.5	25
VI. PAPER AND PRINTING	159.5	106
Paper and wood pulp	166.9	20
Printing and publishing	151.4	79
Paper boxes	251.5	7
VII. CHEMICALS AND ALLIED PRODUCTS	149.4	107
Chemicals and acids	169.8	24
Coke	78.9	5
Gas	97.5	16
Fertilizers	77.0	5
Explosives	66.8	3
Paint and varnish	143.3	12
Petroleum refining	295.1	27
Oil and cake, cottonseed	82.0	4
Turpentine and rosin	159.3	2
Salt	115.2	2
Soap	106.0	7
VIII. STONE, CLAY AND GLASS PRODUCTS	117.3	33
Clay products	46.3	10
Cement	95.7	7
Glass	229.3	16
IX. NONFERROUS METALS	95.8	40
Brass, bronze and other	110.9	12
Smelting and refining	79.6	8
Other industries	94.6	20
X. TOBACCO MANUFACTURES	137.2	16
Tobacco	80.8	3
Cigars	66.3	5
Cigarettes	263.5	8
XI. VEHICLES FOR LAND TRANSPORTATION	130.1	36
Automobiles	208.9	31
Carriages and wagons	13.7	1
Railway equipment	5.8	4
XII. SHIP AND BOAT BUILDING	2.0	12
XIII. RUBBER PRODUCTS	134.4	22
Tires and inner tubes	145.9	19
Boots and shoes	79.9	3

ACCIDENT STATISTICS

An American Standard for Compiling Industrial Injury Rates has been developed by the Sectional Committee on Compiling Industrial Injury Rates organized by the American Standards Association. The American Statistical Association is represented on this Committee by Dr. Eugene B. Patton. A new Standard just approved by the American Standards Association is a revision of a standard which goes back about 20 years and was published in 1920 in Bulletin 276 of the U. S. Bureau of Labor Statistics. In the development of this new Standard difficult problems of definition and rate making were encountered. Copies of the Standard may be secured at twenty cents each from the American Standards Association, 29 West 39th Street, New York, New York.

A revised Accident Cause Code has been developed by the Subcommittee of the Sectional Committee on Standardization of Methods of Recording and Compiling Accident Statistics of the American Standards Association under the chairmanship of Mr. H. W. Heinrich. The proposed code is distinguished by the following features:

(*a*) Mutually exclusive headings are provided.

(*b*) Headings are defined.

(*c*) Six factors, commonly admitted to be of major interest in accident prevention, are included for the first time in any code.

(*d*) Provision is made for separately recording the unsafe practices of persons, for the first time in any code.

(*e*) Provision is made for recording the reasons why persons act unsafely, for the first time in any code.

(*f*) Complete rules for application, extensive enough to cover all contingencies, are provided.

The coder is assumed to have before him a report of accident investigation, preferably one which is specially designed to bring out the facts to be recorded under the six specific headings. It is worthy of mention, incidentally, that trial has already shown that "run-of-the-mine" accident reports today, incomplete as they admittedly are, can be handled by the proposed code to good advantage.

The first task is the selection of an agency. In accordance with the rules, the coder determines what machine, object, or substance best identifies the accident. If he finds that the injured person sustained a fractured leg because of a fall over a loose and up-tilted plank in a floor while carrying a box so that it obscured his vision, he immediately names "wood floor" as the agency. This selection is made because the floor is defective and it caused the accident which in turn resulted in the injury.

The part of the agency is recorded as "none," inasmuch as the agency "wood floor" in the code has no "parts."

In coding "kind of accident" the coder finds at once that "Falls on level" fits the accident description exactly.

The coder then considers the matter of selecting the unsafe act or "performance of person." He notes in the accident description that the injured employee was carrying a box in such a manner as to prevent him from seeing where he was going, so he selects as the code item "Handling box unsafely."

Then follows the selection of a personal cause or reason for the violation of safe practice. If the report shows that the employee had been warned and instructed the coder selects "Willful disregard of instructions."

The determination of a mechanical cause is simple. There is nothing broken or weak, and guarding is not an issue—the coder thus selects "defective" as the correct item.

In narrative form the coded information can now be read as:

Employee, willfully disregarding instructions to carry material safely, falls on a defective wood floor and is injured.

In practical application the proposed code has been found to be workable and to produce results of greater specific value than could be obtained by use of other codes. It should go a long way towards meeting the growing and insistent demand for more and better factual data of value in the prevention of industrial accidents.

Whereas many codes used in the past have been attempts to include in a single list a number of important factors in the causation of accidents, the proposed code recognizes six different kinds of factors, each of which is usually represented in any single accident. The code provides for the recording and coding of the following classes of facts:

1. The agency—meaning the machine, tool, vehicle, animal, dust, gas, liquid, or other object or substance, that, chiefly because of its dangerous condition and the importance of the part it plays in causing the injury, best identifies the accident.
2. The agency part—meaning the particular part of the recorded agency of chief interest because of its dangerous condition.
3. The kind of accident—meaning the fall of a person, the fall of an object, caught in or between, struck by, or other event causing and immediately preceding or accompanying the injury.
4. The unsafe act of person—meaning the violation of a commonly accepted safe-practice rule, contributing to or resulting in the accident.
5. The personal cause or reason why a worker acts unsafely—meaning the willful disregard of instructions or other mental or physical characteristic permitting or prompting the violation.
6. The proximate mechanical cause—meaning the defect, or absence of guard, etc., causing the accident or contributing directly to it.

CONSOLIDATION OF THE DIVISION OF CURRENT BUSINESS STATISTICS AND THE DIVISION OF MANUFACTURES, BUREAU OF THE CENSUS

The Secretary of Commerce, under authorization contained in Section 601, Title 5, U. S. C., issued orders, effective October 25, 1937, for the consolidation of the Division of Current Business Statistics (Special Tabulations), headed by Mr. Thomas J. Fitzgerald, Chief Statistician, with the Division of Manufactures. The personnel of the Division of Current Business Statistics was transferred to the consolidated Division of Manufactures. Mr. Fitzgerald has been appointed Chief Statistician of the Division of Manufactures.

By transfer from the Central Statistical Board, Mr. Howard H. McClure has been appointed Assistant Chief Statistician of the Division of Manufactures. Under the reorganization there will be ten professional technical positions in the division.

Mr. LeVerne Beales, Chief Statistician of Manufactures, was transferred as of the same date to the Division of Territorial, Insular, and Foreign Statistics as Chief Statistician.

Mr. Ray Hurley, who has been Assistant Chief Statistician of the Division of Territorial, Insular, and Foreign Statistics (Acting Chief Statistician), is at present on loan to the President of the Commonwealth of the Philippines as a technical consultant in connection with the census of the Philippines, and is expected to return to his position of Assistant Chief Statistician of this Division prior to the Decennial Census of 1940.

Mr. John F. Daly, Assistant Chief Statistician of the Division of Manufactures, has been designated Technical Assistant to the new chief and assistant chief of the consolidated division.

The compilation and publication of the *Statistical Abstract* has been transferred, by order of the Secretary, from the Bureau of Foreign and Domestic Commerce to the Bureau of the Census, and will be under the immediate supervision of Mr. LeVerne Beales.

In connection with the current business statistics, other than those specifically provided for by special acts, a cooperative arrangement has been set up by the Secretary of Commerce between the Bureaus of Census and Foreign and Domestic Commerce whereby the Bureau of the Census will collect and tabulate the material, and the Bureau of Foreign and Domestic Commerce will analyze and interpret the results. The publications will be issued by the Department of Commerce under the Secretary's signature, with joint responsibility and credit being given to both the Bureau of the Census and the Bureau of Foreign and Domestic Commerce.

In the working out of plans for cooperation, the preparation of schedules, and the conduct of the inquiries, a committee has been appointed made up of two representatives from the Bureau of Foreign and Domestic Commerce, Dr. Nathanael H. Engle, Assistant Director, and Dr. Wilford L. White, Chief of the Division of Marketing Research and Service; and two from the Bureau of the Census, Dr. Vergil D. Reed, Assistant Director, and Mr. Thomas J. Fitzgerald, Chief Statistician of the Division of Manufactures; with a fifth member representing the Central Statistical Board. At present the representative of the Central Statistical Board is Dr. Morris A. Copeland, Executive Secretary of the Board.

OLIVER C. SHORT
Assistant Director

Bureau of the Census
Department of Commerce

PROGRESS OF WORK IN THE CENSUS BUREAU

PUBLICATION OF THE 1935 CENSUS OF MANUFACTURES

The preparation of the final reports of individual industries enumerated in the 1935 Census of Manufactures was completed in August, 1937, the last of the manuscript being sent to the Government Printing Office near the close of that month. These reports, which were issued in a series of 53 octavo pamphlets, each covering a small group of closely related industries, will constitute the greater part of the final report of the Census of Manufactures, to be published in a cloth-bound octavo volume of approximately 1,300 pages. As the last of the industry reports was not received from the Government Printing Office until November, it was impossible to print the volume itself in 1937.

Two series of State reports (multilithed) have been issued, one giving summary statistics by industries, and the other, summary totals for cities and counties. Another series of reports gives statistics by industries for 32 industrial areas.

Statistics of establishments classified by size as measured by the number of wage-earners employed have been published in multilithed tables giving the total number of wage-earners and the total number of establishments in each size group. The figures, which cover 1933 as well as 1935, are shown by industries and by states. This will be the first tabulation of the kind to be published since the census of 1929.

CENSUS OF ELECTRICAL INDUSTRIES

The Bureau is getting ready for the next quinquennial census of electrical industries which will cover the calendar year 1937. The questionnaires have been revised to meet the changes that have occurred in kinds of operations since the last census. They apply to the following types of industries: (1) telephones (connecting lines and systems), (2) telephones (operating companies), (3) street railways (operating companies), (4) street railways (non-operating and lessor companies), (5) motor-bus operations, (6) trolley-bus operations, (7) telegraphs, and (8) electric light and power industry. Separate schedules for radiotelephones and radiotelegraphs are being considered.

FINANCIAL STATISTICS OF STATES AND CITIES

The 1935 report on Financial Statistics of Cities of over 100,000 Population (175 pages) was issued in September; and press releases for 1936 have been issued for most of the cities. The schedules as revised for 1936 called for more detailed statistics on certain subjects, including grants-in-aid and relief expenditures, method of financing outlays, tax collections and delinquency, interest rates on bonds, and number of city employees by departments.

The Bureau, in cooperation with the Treasury Department, Division of Research and Statistics, made an inquiry on state and local debt in 1937 including status of sinking and trust funds, and related data. The inquiry covered all states, 607 counties, 983 cities of over 10,000 population, and 264 districts (i.e., port, bridge, road, and irrigation); also debts of school districts as of June 30, 1936, as reported by states to the Office of Education.

In cooperation with the Bureau of Foreign and Domestic Commerce, an inquiry on chain-store tax collections has been made in 17 states.

CENSUS OF AGRICULTURE, 1940

Preparations are being made for the 1940 census of agriculture. A trial schedule has been printed and instructions to enumerators prepared. In addition, considerable exploratory work is being done using census data by minor civil divisions to determine the best method of sampling. Much attention has been given to answering inquiries which arise from farm mapping programs, research projects, and other questions brought up by the expanding use of farm census statistics.

VITAL STATISTICS

The fourth volume of the *Vital Statistics—Special Reports* series giving state summaries of vital statistics for the year 1936 is now being published. Two new tables have been included. One is a table for the year 1935 distributing births and deaths according to place of residence. This gives the total number of births and deaths and the number of non-resident births and deaths occurring in each city and in the rural area of each county; the number of residents of the city or rural area born or dying elsewhere either in the same state or in other states; and the total number of births and deaths of residents wherever occurring.

This is the first time that it has been possible to make a complete allocation of births and deaths in the United States according to place of residence. It is of course not possible to do that until the returns are available for all states; and that is the reason why in the current series of state summaries the complete allocation is given for 1935 but not for 1936. However, an allocation by residence limited to births and deaths occurring within the state is presented for 1936 as it has been for previous years.

The other new table referred to above gives for the state the deaths from cancer distributed according to the principal anatomical site of the tumor.

J. A. H.

STATISTICAL NEWS AND NOTES

CENTRAL STATISTICAL BOARD.—*Current Business Inquiries in the Department of Commerce.* The Secretary of Commerce on March 20, 1937, requested the Central Statistical Board to make recommendations with regard to the work of collecting and compiling various current business statistics within the Department of Commerce. In response to this request, the Central Statistical Board established a committee composed of Messrs. Frederick C. Mills, Columbia University (Chairman); Walter White, Assistant to the Chairman of the Business Advisory Council for the Department of Commerce; and O. C. Stine, Chief, Division of Statistical and Historical Research, Bureau of Agricultural Economics. A representative of the Bureau of the Budget sat with the Committee.

The Committee invited representatives of the Bureau of the Census, the Bureau of Foreign and Domestic Commerce, other interested Federal agencies, and several trade associations to present facts and to make suggestions. Its report which was submitted to the Secretary of Commerce on May 29, 1937, recognized "that any final determination regarding the assignment of functions will necessarily involve questions of an administrative character of which the Committee has not been expected to take account." The report, in brief, recommended:

1. "As a long-run policy, and with exclusive reference to the activities of the Bureau of the Census and the Bureau of Foreign and Domestic Commerce, the functions of collection and primary compilation of current data respecting domestic business activity should be assigned chiefly to the Bureau of the Census, these duties to be combined in detailed assignments with those involved in the conduct of business census enumerations . . . "

2. "As a matter of policy and with exclusive reference to the activities of the two bureaus, the functions of analyzing and interpreting current business conditions and economic developments and of selective publication of current business and industrial data should continue to be assigned chiefly to the Bureau of Foreign and Domestic Commerce. . . "

3. "The proper development of a new current reporting service calls for a large measure of analytical work. As an example, the Committee cites the current situation in the collection of monthly data on wholesale and retail trade. Until a standardized working procedure has been developed, the Bureau of Foreign and Domestic Commerce should probably continue these services. When they have been more fully organized it may be expected that the task of analysis will require the full attention of the personnel engaged in this field by the Bureau of Foreign and Domestic Commerce, and that collection and compilation may be delegated to the Bureau of the Census. . . "

4. "It is assumed that the compilation of statistics on foreign trade and international capital movements will continue in the Bureau of Foreign and

Domestic Commerce, and that the Bureau will continue to conduct special statistical inquiries from time to time in the field of domestic business."

Supplementing these specific recommendations, the Committee emphasized the importance of "close and continuing cooperation between the two bureaus in the development and prosecution of a well-balanced and competent program of current business reporting" and the importance of recruiting professional personnel adequate to the needs of such a program.

Participation in the Census of Partial Employment, Unemployment and Occupations. At a meeting of the Central Statistical Board, on October 8, the following resolution was unanimously adopted:

> "Whereas, the Congress has directed the President to take a census of partial employment, unemployment and occupations, to meet the urgent need for information about the problems of reemployment, social security and unemployment relief; and
>
> "Whereas, the President has emphasized the utmost importance of securing a complete, honest and accurate count; and
>
> "Whereas, it is a function of the Central Statistical Board to investigate and make recommendations with respect to statistical work carried on by Federal agencies; therefore
>
> "Be it resolved that the Central Statistical Board offers to the Administrator of this census its full cooperation toward the successful attainment of the objects of the census; and
>
> "Be it further resolved that the Central Statistical Board believes that it can cooperate most effectively by establishing a special committee, supported by a special section of the Board's staff, to aid and advise the Administrator and his technical staff."

The Committee which was established by the Board in accordance with the above resolution is composed of the following persons: Mr. Stuart A. Rice, Chairman of the Central Statistical Board, Chairman; Mr. W. L. Austin, Director of the Bureau of the Census; Mr. E. Dana Durand, Commissioner of the Tariff Commission; Mr. Corrington Gill, Assistant Administrator in charge of Research, Statistics and Finance of the Works Progress Administration; Mr. Oscar E. Kiessling, Chief Economist, Mineral Resources and Economics Division, Bureau of Mines, Department of the Interior; Mr. Isador Lubin, Commissioner of Labor Statistics; Mr. Frederick F. Stephan, Secretary-Treasurer, American Statistical Association; Mr. Morris A. Copeland, Executive Secretary of the Central Statistical Board; and Miss Aryness Joy, Chief Economist of the Central Statistical Board, Secretary. The suggestions made by this committee are being transmitted to Mr. Biggers, Administrator of the Census of Partial Employment, Unemployment and Occupations.

Curtailment of the Appropriation of the Central Statistical Board for the Fiscal Year 1938. In June of this year Congress cut in half the appropriation for the work of the Central Statistical Board in the fiscal year 1938. The Board is currently operating with half the funds spent in each of the three preceding years. Consequently, it has been necessary to curtail its staff and work drastically.

A number of important activities have been abandoned entirely; other responsibilities are being met only in special cases. The direct participation of the Board in the joint review and supervision of statistical projects carried on under the Works Program through a committee known as the Coordinating Committee of the Central Statistical Board and the Works Progress Administration has been discontinued and the Committee dissolved. The review of statistical releases and publications, over 400 of which were examined during the 1937 fiscal year, has also been practically stopped. The work of assembling descriptions of statistical data available in various fields and of reviewing research in process has been dropped for the year. The weekly review of economic conditions, prepared by the Board in cooperation with other Government agencies since April 1935 for broadcasting to our embassies abroad and for circulation to Government executives, has been discontinued. Various types of requests are now granted only under exceptional circumstances.

In the past the Board has been called on frequently to make special inquiries into administrative problems of the statistical services, to provide technical advice and assistance on inquiries in process and for the improvement of statistical data collected regularly by the Federal Government, and to prepare special reports on various aspects of current economic and social conditions for the use of the President, members of the Cabinet, and heads of executive agencies. The Board is continuing to work on a number of projects started in earlier years, but beyond these it will probably be necessary to postpone practically all requests until next year.

Continuation of some of the Board's work has been made possible by arrangements for the reimbursement of the Board for the time of its staff by specially interested agencies. For example, the Bureau of Labor Statistics is reimbursing the Board for the continuation of technical advice in the Study of Urban Consumers' Purchases. Another member of the Board's staff is continuing his work in the field of mineral statistics, with the help of the Bureau of Mines. Still another staff member has been enabled to continue the advisory assistance which the Board has been giving the Civil Service Commission in connection with the rating of the Social Science Analyst examination by a similar arrangement. As previously noted in this JOURNAL, the Board has also been assisted in meeting its financial problems by arrangements with the National Resources Committee for the preparation of a Government chart book of current economic and social series, including descriptive and critical comments. A substantial share of the time of the staff during the past few months has been devoted to preparing this chart book in cooperation with the National Resources Committee.

From a long run point of view, the most important project of the Board, which has been continued largely by the assistance of other agencies, is the development of a standard classification of industries. It is hoped that this classification, which is now not far from completion, will be adopted by the Census Bureau, the Bureau of Labor Statistics, and the Social Security Board immediately on its completion, and that other agencies will then fall in line.

The Board is continuing its regular review of questionnaires and plans for statistical inquiries. These reviews have been a major part of the Board's work since its inception and are the basic means through which it exercises its coordinating functions.

DOMINION BUREAU OF STATISTICS, CANADA.—*Financial Statistics.* From July 19th to 22nd, 1937, a Dominion-Provincial Conference on Municipal Statistics was held in Ottawa to study the different phases of the problem of the uniform presentation of municipal statistics, a subject which falls within the administrative jurisdiction of the Provincial Governments under the Canadian Constitution. The Provincial Governments were all represented and in addition the Canadian Federation of Mayors and Municipalities, the Municipal Finance Officers' Association of the United States and Canada, the Ontario Mayors' Association, and a number of leading cities also sent delegates. The Dominion Government was represented by officials from the Dominion Bureau of Statistics, the Department of Finance, the Department of Labour and the Bank of Canada. Dr. R. H. Coats, Dominion Statistician, was nominated Chairman.

The Conference decided upon uniform methods of accounting, statistical practice, and terminology. Agreement was reached on the exchange of such information as would facilitate this purpose.

The Dominion Bureau of Statistics was requested to undertake, in cooperation with the provincial Departments of Municipal Affairs, a study of existing legislation and the forms at present in use for the collection of municipal statistics throughout Canada with a view to the classification of different types of local government units.

Continuing subcommittees were constituted to deal with particular problems, including: (a) general municipal statistics; (b) revenue, expenditure and classification of municipal accounts; and (c) assessment and population matters.

NATIONAL RESOURCES COMMITTEE.—*Report of Urbanism Committee.* Released under the title "Our Cities—Their Role in the National Economy," the report contains a number of recommendations approved in principle by the National Resources Committee, which, if carried out, would enable the Federal Government to concern itself with city dwellers as it has with farmers through the Department of Agriculture.

The major recommendations follow, in part:

> That the efforts already made by government, industry and labor toward increasing economic security be intensified and that the United States

both study and act upon the problems of chronically depressed urban areas.

That the Federal Government should continue its policy of assistance to the social welfare programs of urban communities.

That a section for urban research be set up in some suitable Federal agency which would perform for urban communities functions comparable to those now performed for rural communities by the Department of Agriculture.

That a clearing house of urban information should be created in the Bureau of the Census which would serve as a central depository of all information about urban communities collected by all governmental agencies and by authoritative private organizations.

That the Central Statistical Board should give special consideration to the inadequacies in the existing urban data.

That a comprehensive and thorough-going inquiry should be made by the present tax revision council or other suitable agency of the entire subject of conflicting fiscal policies and taxation in local, State, and Federal Governments.

That Congress should pass legislation laying down the conditions under which there may be adopted interstate compacts enabling the several communities within the same metropolitan region, but in separate States, to deal jointly with the regional aspects of health, sanitation, industrial-waste regulation, etc.

That legislation should be considered primarily for periods of economic distress creating a Federal credit agency authorized to make loans and grants under adequate legislative safeguards to local governments for the purposes of public works construction, acquisition or construction of public utilities, land purchases, and similar outlays. At the same time, the Committee believes that direct Federal expenditures in cities should be reduced to a minimum.

Report of the Science Committee. The first report on the science resources of the United States (entitled "Technological Trends and National Policy") deals with new inventions and their social implications and calls attention to the need for planning to meet the new situations caused by technological advance.

Prepared by a large group of scientists and engineers, the report "presents a survey of most of the great fields of technology and applied science, namely, agriculture, mining, transportation, communication, the construction industries, power production, the metallurgical and chemical industries and the electrical manufactures.

"The purpose is to cover a wide range; for the specialization so necessary for progress needs to be accompanied by broader vision. It was possible to obtain this wider perspective by dealing only with the more significant inventions. Since inventions were selected for this report on the basis of their social significance, omissions are important as truly as inclusions, especially as the surveys were conducted by competent authorities in the different fields."

"It has been thought best to focus on the near future, which is defined as the next twenty years; but any blinders that cut off sharply the present, the more distant future, or even the recent past, would mean an inadequate investigation, since change is a process."

A Federal Committee should be responsible, according to the report, for keeping abreast of technological changes and for forecasting imminent changes that may affect national life. This Federal group should be composed of representatives of the Departments of Labor, Commerce and Agriculture, the Bureau of Mines, the Interstate Commerce Commission, the Social Security Board and the Works Progress Administration with such cooperation from industry and research organizations as may be necessary to obtain complete information.

The National Resources Committee also urges that a series of continuous studies, independent of the Joint Committee of Federal agencies, be undertaken by existing planning boards and by appropriate agencies developed by the Federal Government—and, more specifically, that there be set up, in the various interested departments, science committees with the definite function of investigating and reporting on the progress and trends of science and invention and the possible social and economic effects which may follow them.

It is recommended that these agencies, with the aid of such natural and social scientists as may be needed, concentrate their initial efforts on the following inventions which promise to play an immediate part in future technological changes; the mechanical cotton picker; air conditioning equipment; plastics; the photo-electric cell; artificial cotton and woolen-like fibers made from cellulose; synthetic rubber; prefabricated houses; television; the automobile trailer; gasoline produced from coal; steep-flight aircraft and tray agriculture.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM.—The August issue of the *Federal Reserve Bulletin* contained tabulations showing the distribution of commercial banks in the United States as of December 31, 1935, by states and geographical divisions on the basis of the amount of loans and investments, amount of deposits, ratio of demand to total deposits, ratio of total capital account to total deposits, and according to the population of the city in which located. The tabulations also included special analyses of banks not on the Federal Reserve par list and of banks with capital stock less than the applicable minimum statutory requirements for Federal Reserve membership or for the establishment of national banks. The September issue of the *Bulletin* contained tabulations analyzing in detail the number, deposits, and loans and investments of suspended banks by geographic divisions, states, months, years, size and class of bank, and size of town, for the period from 1921 through 1936.

In connection with a discussion of gold and capital movements in the last quarter of 1936 and the second quarter of 1937, there was published in the *Federal Reserve Bulletin* for August 1937 a table on the sources and uses of gold from January 1931 to June 1937. The table shows, on an annual basis, the amount of gold derived from new production and other sources, the absorption of gold into central reserves and industrial uses, and the indicated increase or decrease in unreported official holdings or private hoards in western countries. The discussion of capital movements in the August *Bulletin* was based on data collected by the Federal Reserve banks for the Treasury. These statistics, covering the first quarter of the year, were published in the *Bulletin* for July, and those for the second quarter in the *Bulletin* for October. Similar data for the period May 1929—December 1936 were published in the *Bulletin* for May.

DIVISION OF RESEARCH AND STATISTICS, FEDERAL HOME LOAN BANK BOARD.—For more than two years an index of the total cost of constructing a standard 6-room frame dwelling has been compiled through the cooperation of field representatives in more than 90 selected cities. This cost index includes the price of building material delivered to the site, the total charges for labor required to complete the construction, and compensation insurance, as well as a percentage of profit for the contractor. The information is reported every three months for four different groups of cities, so that a particular cycle of building cost indexes is available each month. Since January 1936 these indexes have been published in the *Federal Home Loan Bank Review*, and each subsequent issue has reprinted the index figures for each of the previous periods.

Since January 1936 this Division has been collecting from approximately 2,500 savings, building and loan associations, monthly reports showing the total volume of mortgage loans made during the month, with a breakdown as to the purpose for which the loan was made. The material is segregated by states and also as to federal associations, state-chartered building and loan associations which are members of the bank system, and non-member institutions. On the basis of reports received from the cooperating associations this Division has prepared estimates of the total volume of new mortgage loans made by all *active* savings and loan associations in the U. S., and in each of our Federal Home Loan Bank Districts.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.—The foreign section (Part II) of the *World Economic Review*, separated for the first time from the United States section, has been recently released. The study presents a review of the economic policies and developments during 1936 in the principal countries of the world. The study reveals that although a certain degree of recovery has been found in most countries, the elements of uncertainty, distrust, and isolation still operate in many areas to prevent a complete return to prosperous conditions. The economic effects of rearmament, of the self-sufficiency programs which are characteristic especially of totalitarian states, and of currency readjustments are discussed in detail. Special attention is given to the recovery in international trade and the extent to which the gains are concentrated in the export trade of producers of raw materials and staple foodstuffs. The few instances of liberalization of commercial policy are noted, but these are confined principally to the broadening of quotas and reductions of duty in connection with currency devaluations in the European area. The more encouraging developments of the year are to be found in the trend toward elimination of currency uncertainties, although the gain in nominal foreign-trade returns as a result of devaluation is largely illusory. Tables in the appendix showing month-by-month production of a few primary minerals and metals reflect both the gradual general recovery and the progressive extension of armament programs. Such sub-headings as industrial production and profits, prices, cost of living, unemployment, wages, agriculture, foreign trade, public finance and private finance characterize the treatment of each nation. Statistics upon each of these important subjects are also given.

The November issue of the *Survey of Current Business* carried a special treatment of "Farm Mortgage Credit 1930–1937" by Norman J. Wall and Frederick M. Cove. The article is based primarily upon a report of the co-operative survey by the Bureau of the Census and the Bureau of Agricultural Economics, entitled "Farm Mortgage Indebtedness in the United States" and a preliminary report on "Outstanding Farm-Mortgage Loans of Leading Lending Agencies." This latter study is to be issued by the Bureau of Agricultural Economics. The article shows the decline in farm mortgage indebtedness as well as the reduction in the number of farms mortgaged, both tenant and owner occupied. The shifting of mortgages due to the refinancing program of the Farm Credit Administration and the consequent effect upon the volume of farm holdings by various types of financial institutions is also revealed.

Summary statistics on national income 1929–1936 have been recently released. This publication brings up to date and revises certain materials contained in the more detailed publication,—*National Income 1929–1935*. Data are presented for income produced and paid out during this period with detailed information as to types and sources of both payments and receipts.

On September 1 the Bureau extended its program of collecting current statistics for independent retailers to eleven additional states. The information at the present time is confined to sales data and monthly releases are issued showing the percentage change in sales by kinds of business from a corresponding month a year ago and from the previous month. These releases also show the changes in total sales by cities and city size groups.

FEDERAL TRADE COMMISSION.—A second report under the Commission's agricultural income inquiry entitled "Fruits, Vegetables and Grapes, Agricultural Income Inquiry," was submitted to Congress in June 1937. This report was made by direction of Public Resolution No. 112, 74th Congress amending the earlier resolution authorizing the inquiry into principal farm products, on which a report was made to Congress in March 1937. The scope of the later inquiry and report was similar to that of the earlier but conditions and conclusions reported greatly differ.

The concentration of handling fresh fruits and vegetables is not significant except in the case of a few cooperatives and other shippers. The California Fruit Growers Exchange, The Florida Citrus Exchange and Mutual Orange Distributors, together marketed 62.85 per cent of the total 1935 production of oranges for fresh distribution. The California Fruit Exchange handled 12.22 per cent of the 1935 grapes distributed fresh and The DiGiorgio Fruit Corporation 10.3 per cent. The Atlantic Commission Company, a subsidiary of the Great Atlantic and Pacific Tea Company, was a large distributor of both fruits and vegetables, but had a smaller percentage for any one item than those cited.

A high degree of concentration was reported in the processing of fruits and vegetables. Three reporting canners together processed from 30.55 per cent to 67.07 per cent of various fruits and vegetables produced in 1935 and used for commercial canning.

For 10 selected fresh fruits and vegetables combined, the growers' portion of the consumer's dollar paid to chain stores in 11 terminal markets was 32.24 cents; distributors' margins were 33.62 cents, including a retail margin of 29.35 cents; freight and other transit costs, 21.59 cents; and packing, loading, storage and miscellaneous costs, 12.55 cents.

A study was made of the investments and profits of fruit and vegetable processors, of the operations and results shown by cooperatives, and of the many alleged unfair and wasteful methods of distribution of fresh fruits and vegetables in the large terminal markets, and several recommendations for improvement through legislation or otherwise were made.

Neither of the reports on agricultural income have been printed but both are available for examination at the Commission's offices. A summary of the earlier report, together with conclusions and recommendations, may be obtained from the Commission in printed form, and the same for the later report may be had in mimeographed form.

COMMODITY EXCHANGE ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE.—The Commodity Exchange Act of 1936 considerably enlarged the scope of the Commodity Exchange Administration. The work of this organization now deals with the regulation of future trading in wheat, cotton, rice, corn, oats, barley, rye, flaxseed, grain sorghums, millfeeds, butter, eggs, and potatoes. A Division of Statistics has been established, and plans are being laid for the release daily of information on volume of trading and open contracts in other commodity futures in addition to the data now being released on grain futures. It is expected that the monthly publication, *Trade in Grain Futures*, will be expanded to present in detail statistical information on other commodities as well as grain.

Starting August 2 new regulations dealing with daily reports of the trades and open interests of large traders in grain futures went into effect. On October 1 similar regulations became operative for cotton, butter, eggs, potatoes, and millfeed. Plans are under way to provide for periodic release of tabulations based on these reports. When all these plans are put into effect the public will have far more complete information on operations on organized commodity markets than have been available in the past or are available for the commodity markets of any other country.

U. S. BUREAU OF MINES.—With the close of the fiscal year ended June 30, 1937, the Bureau of Mines relinquished to the National Bituminous Coal Commission the collection of statistics relating to the coals subject to the jurisdiction of the Bituminous Coal Act of 1937. The Bureau, however, will continue to collect data on accidents occurring at all coal mines. Broadly, the Bureau of Mines retains jurisdiction over the collection of statistics relating to anthracite, semi-anthracite and lignite coals, coke, fuel briquets and packaged fuel, and the international coal trade.

As a part of its improved service to the fertilizer industries, the Bureau recently inaugurated a semi-annual report of phosphate rock which provides a new base line on fertilizer sales. The first report of this series covers the period January 1–June 30, 1937.

A physical inventory of stocks of crude oil in the United States was made during the fiscal year ending June 30, 1937, and a preliminary report of the results was published July 13, 1937. The primary objective of the study was to ascertain the volume of stocks above ground and to determine the quantities of light fractions in the various stocks, especially those which had been in storage for a considerable time.

As a result of cooperative studies on mineral technology and output per man by the Bureau of Mines and the Works Progress Administration, as a part of the National Research Project on reëmployment opportunities and recent changes in industrial techniques, the following reports have been published in recent months:

Technology and the Mineral Industries by F. G. Tryon, T. T. Read, K. C. Heald, G. S. Rice, and Oliver Bowles, (Report No. E-1. April 1937);

Small-Scale Placer Mines as a Source of Gold, Employment, and Livelihood in 1935 by Charles White Merrill, Charles W. Henderson, and O. E. Kiessling, (Report No. E-2. May 1937);

Mechanization Trends in Metal and Nonmetal Mining as Indicated by Sales of Underground Loading Equipment by L. N. Plein, F. E. Berquist, and F. G. Tryon, (Report No. E-3. June 1937);

Employment and Related Statistics of Mines and Quarries, 1935 Part I—*Bituminous Coal*, by F. G. Tryon, W. H. Young, M. E. Wilson, and F. E. Berquist;

Part II—*Pennsylvania Anthracite*, by F. G. Tryon, M. Otero, W. H. Young, and D. C. Ashmead, (Report No. E-4. July 1937).

AGRICULTURAL ADJUSTMENT ADMINISTRATION.—*Agricultural Conservation Program for 1938.* The outline of the 1938 Agricultural Conservation Program was announced on September 20, 1937. Under this program, acreage goals are established for corn, cotton, flue-cured, Burley, fire-cured, dark air-cured, and cigar filler and binder tobaccos, peanuts, rice, potatoes, and general soil-depleting crops; and provision is made for establishing individual farm goals for each of these crops or groups, as well as for soil-building crops and practices which should be carried out on the farm. The national goals for soil-depleting crops in comparison with 1928–37 average acreages are:

Crop	*Acreage* 1928–37 (Thousand Acres)	1938 Goal (Thousand Acres)
Corn	102,468	92,000– 96,000
Cotton	36,858	27,000– 29,000
Rice	900	825– 875
Tobacco		
Flue-Cured	924	850– 900
Burley	394	480– 500
Fire-cured and Dark Air-cured	231	170– 180
Cigar filler and binder	98	85– 90
Peanuts	1,544	1,500– 1,600
Potatoes	3,346	3,100– 3,300
General	157,480	145,000–155,000
All Soil-Depleting*	305,000	273,000–288,000

* Sugar beets and sugarcane included.

County goals for cotton, tobacco, and rice will be established for each county where such crops are grown; and county goals for corn, potatoes, and peanuts will be established only for those counties which are in the principal commercial producing areas designated by the Agricultural Adjustment Administration.

County committees will establish soil-depleting and soil-building goals for individual farms, taking into consideration the tillable acreage on each farm, the type of soil, topography, production facilities, crop rotation, acreages customarily grown and acreages of food and feed crops needed for home consumption, acreage of new seedings, and the extent to which liming, terracing, contour listing, and other soil-conserving or erosion-control practices are needed to promote agricultural conservation.

A maximum payment will be calculated for each farm. Payment will be made for keeping within the general soil-depleting goal and the individual crop goals, and for attaining the soil-building goal established for the farm. Where the soil-depleting goal is exceeded or the soil-building goal is not reached, the payment will be less than the maximum payment. The payments will be divided between landlords and tenants in the proportion that they share in the principal crop, or all crops and practices on the farm. Specific provisions applicable to the Great Plains area encourage the restoration to grass of land which should never have been plowed.

The same administrative set-up will be used as in the past. This involves the county agricultural conservation associations as the local administrative agencies working under the direction of State committees, which are in turn responsible to the Regional Divisions of the Agricultural Adjustment Administration. Since the actual appropriation has not been made, the 1938 program is dependent upon the action of Congress, although in 1936 Congress authorized an annual appropriation for carrying out such a program under the Soil Conservation and Domestic Allotment Act.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR.—A survey of paid vacation practices in American industry is being made by the Bureau. The survey includes both salaried employees and wage earners and will cover both manufacturing and nonmanufacturing establishments. It will deal with such points as the extent to which paid vacations are being granted; the length of the vacation period; the method of computing service; the time of year when granted; and the method of remuneration.

The wage survey of the bituminous-coal industry is well advanced, two articles having already been published in the *Monthly Labor Review*, one dealing with annual earnings and the other giving summary data, by states. In connection with the survey of the cotton-textile industry it is expected that preliminary results will be available shortly. A study of wages, hours, and annual earnings in the radio and phonograph manufacturing industry is in progress, covering about half the industry. This will be followed by a similar study of the electrical machinery and apparatus industry. A report on wages and working hours in the quarrying and finishing of granite is practically finished. Data were obtained for 185 establishments having 5,400 employees and representing 50 per cent of the entire industry. The Bureau's usual annual survey of entrance wage rates of common unskilled labor was made as of July 1, 1937. Twenty industries and more than 5,000 establishments, having over 200,000 employees, were included this year. The annual survey of union-wage scales as of May 15, 1937, has been completed. The preliminary results for the building trades appeared in the *Monthly Labor Review* for November 1937.

Arrangements are being made for a study comparing contract prices for construction projects with permit valuations, in order to ascertain how closely valuations quoted when building permits are obtained approximate actual construction costs. The coverage will be 25,000 residential buildings for which the Federal Housing Administration has issued commitments to insure. Tabulations will be made by building-cost groups and by cities.

In connection with the Bureau's regular reports on employment and pay rolls in manufacturing and nonmanufacturing industries, the statistics are being broken down by sex for 38 manufacturing industries, laundries, and cleaning and dyeing establishments. The industries selected for such analysis are those where a large number of women are employed. It is planned for the future to prepare such reports semi-annually, in March and September.

As part of the program of the wholesale-price reporting service of the Bureau, there has been adopted a revised method for computing the index number of wholesale commodity prices. The change in method was introduced with the calculation of the index for July 1937 and extended back to January. It is the customary weighted aggregate method with a fixed base and replaces the chain-index method of the aggregate type previously used. The procedure used is described in an article in this issue of the JOURNAL. Surveys have been completed for the improvement of the wholesale price reports for the cement and soap industries. The reports covering these two industries will be similar to the one issued for the farm-machinery industry and will give in detail the price data used in the calculation of the revised indexes, with brief discussion of the methods of computation. Other industries and important items being surveyed are lumber and millwork, brick, shoes and other leather products, automobile tires and other rubber products, chemicals, insulation and wall board, tile, fiber board, and small implements and tools.

UNITED STATES EMPLOYMENT SERVICE.—*Detailed Survey of Characteristics of Persons Seeking Work through the United States Employment Service.* A detailed survey of all persons actively registered during November as seeking jobs through the offices of the United States Employment Service is now being prepared. This survey, which will continue studies made through four similar inventories taken during the past two years, will furnish information concerning the occupational and industrial classification, age, sex, color, veteran classification, and geographical distribution of the active job-seekers. In addition, it is planned that the survey will indicate which of the registrants seeking work through the public employment offices in November were actively registered at the time of the July inventory survey. The present study coincides in timing with the voluntary census of unemployment.

Horizontal Classification of Jobs. Work on a preliminary horizontal classification of jobs in a number of industries has been started in an attempt to classify these jobs into groups or families of occupations. This horizontal classification is being made by grouping occupations on the basis of similarities of what the workers have to know, do, and be in order to perform their work satisfactorily. It is proposed to organize the information which has been and which is being collected regarding occupations and to study it carefully to find the degrees of similarity of occupations and some workable basis for classifying occupations on the basis of similarities of worker requirements.

CHILDREN'S BUREAU, U. S. DEPARTMENT OF LABOR.—Collection of schedules for the study of stillbirths undertaken by the Children's Bureau beginning February 1, 1936, was terminated May 31 of this year. A total of 6,750 schedules for this study have been received from 229 hospitals in 49 cities in 26 states and the District of Columbia. The tabulation of this material is well under way, and some preliminary findings have been released.

From an analysis of the data on the schedules certain basic information has been obtained with respect to color, age and parity of mothers, incidence of plural births, and sex of the stillborn infants. As was to be expected in a study of hospital cases, it was found that the mothers were slightly older and that there was a greater proportion of primiparae and of white mothers than is shown by census reports on stillbirths. Data in regard to sex of the stillborn infants and in regard to the incidence of plural births were, however, in close agreement with census figures.

The stillbirths were studied (1) in relation to whether the fetal death occurred before the onset of labor or during labor, (2) in relation to the period of gestation at which stillbirth occurred, (3) the method of delivery, and (4) the frequency of certain complications of pregnancy and labor and certain conditions in the infants.

In continuation of the reorganization of the Division of Statistical Research of the Children's Bureau, mentioned in the June issue of this JOURNAL, all units collecting recurrent statistical reports have been combined into a Current Statistics Section. Statistical reports now maintained currently by the Bureau include welfare statistics for large cities, collected in connection with the Bureau's Social Statistics Project, reports on employment certificates issued to minors, reports on delinquency cases handled by the Juvenile Courts, and reports on activities of the maternal and child-health and crippled children's programs conducted by the Bureau under the Social Security Act. The Current Statistics Section is in charge of Mr. Louis J. Owen, formerly State Coordinator of Statistical projects for the Illinois Works Progress Adminitsration.

WOMEN'S BUREAU, U. S. DEPARTMENT OF LABOR.—The Women's Bureau is conducting a number of surveys of women's wages and hours in states requesting such data for use as a basis in determining minimum wages. Field work is now in progress on such a study of Colorado, made in cooperation with the State Minimum-Wage Division and the report on a similar survey of Utah is nearing completion. In the State last named, 153 establishments were visited and pay-roll data taken for more than 5,000 women, the largest numbers being in stores and manufacturing plants, with appreciable numbers in laundries, hotels, and restaurants. Average weekly earnings of women in the various industries (excluding hotels and restaurants, where the cash wage is not always representative) ranged from $11.05 to $15.75, hourly from 25 to 37 cents.

A report on "Differences in the Earnings of Women and Men" is now in press as Bulletin 152. The information presented is based on several field surveys, with supplementary material from other federal and state sources. The general levels of men's and women's wages are shown in various manufacturing, sales, and clerical occupations, and also the pay they receive for work of identical or essentially similar character. The data collected show that women's wages fall below men's with an almost uncanny uniformity in degree, regardless of changes in the general wage level, in business conditions, in source of labor supply, or other measurable factors, and for the most part this is true even where exact occupations can be compared with reasonable accuracy.

A general survey entitled "Women in the Economy of the United States of America" is shortly to come from the press, containing a wide range of information from many sources, initiated by a request of the International Labour Office. This report includes data on women's occupational trends, wage status, unemployment, and responsibility for the support of others, and on the experience in this country as to the effects upon women of labor legislation applying especially to them.

Working with a committee of experts on budget requirements, the Women's Bureau has been working out a series of suggested essentials for the budget of an employed woman, which can be furnished to states for use in estimating cost of living prior to the establishment of a minimum wage, the items included to be priced locally within the state before making the estimate required.

OFFICE OF EDUCATION.—Reprints of the series of *School Life* articles on subject-registrations in public high schools are available. The annual study of "College Receipts and Expenditures," (1936–37) a sampling of about 300 institutions, and the annual "Statistics of Land-Grant Colleges" (1936–37) will be available from the Office of Education in November. The annual study "Per Capita Costs in City Schools" (1936–37) will go to the printing office in November.

In response to the request of the National Council of Chief State School Officers, the Office of Education has, during the past eighteen months, cooperated with the states in a program directed to such revisions of the respective systems of school records and reports as will be conducive to securing greater uniformity with consequent greater comparability of local and state school statistics. The field representatives of the Office of Education have personally conferred with the person or persons in charge of records and reports in the state departments of education. Findings from analyses made by this Office of certain basic record and report forms of the states were used as the basis of discussion at each of five regional conferences held last spring in Washington, D. C., Springfield, Ill., Salt Lake City, Utah, Montgomery, Ala., and Hartford, Conn. These conferences are reported as being of real assistance to the states in their efforts to make changes in record and report forms now in use.

The progress in this program has been made possible because of the active cooperation of the state departments of education, the National Advisory Committee on School Records and Reports, appointed by the Commissioner of Education, and other agencies interested in such records and pertinent educational data.

Statements and requests to this Office indicate that states are making certain revisions in forms used during the current year; others are to be made later. Indications now are that this cooperative program will probably be extended to cover at least another year.

BUREAU OF RESEARCH AND STATISTICS, SOCIAL SECURITY BOARD.—*Division of Public Assistance Statistics.* This Division has summarized recently the statistical data on public assistance for the fiscal year 1936–37 which will appear in the Annual Report of the Social Security Board. In addition to its collection of monthly reports on operations under the Social Security Act the Division has carried on its activity in the field of public welfare statistics.

General Relief Statistics: Complete data on general relief for 29 states and partial data for 18 states for the month of August 1937 were published in *Public Assistance, Monthly Statistics for the United States* on October 12. Continued field work by representatives of the Division is bringing to light many of the inconsistencies in State reports and is contributing gradually to the completeness and accuracy of the data. Revision of the publication policy of the Social Security Board has necessitated the elimination of the separate bulletin entitled *General Relief Statistics* but data on general relief are included in the *Social Security Bulletin*, formerly *Selected Current Statistics.*

Relief in Urban Areas: Reexamination of the relief data collected monthly from 116 urban areas since 1929 and addition of reports for the Civil Works Administration and the Works Program have delayed the monthly publication of *Relief in Urban Areas* since the May issue. Publication will be resumed with data which will present a more accurate statement of the trend of total relief for these important urban areas.

Relief in Rural Areas: The collection of relief statistics from selected rural counties was transferred from the Works Progress Administration to the Social Security Board on July 1, 1937. The Board's first issue of *Current Statistics of Relief in Rural and Town Areas*, for the month of July, will appear about October 28.

Total Relief in the United States: For the month of August 1937 the Board published in *Public Assistance, Monthly Statistics for the United States* two tables and one chart on all public relief programs in the United States. The monthly publication of these summary figures is continued in the *Social Security Bulletin.*

Social Data about Recipients of Public Assistance: Before September 1 all states participating under the Social Security Act had submitted their annual reports of social data about recipients of public assistance for the fiscal year ended June 30, 1937. These reports covered a sample of 886 thousand persons to whom formal grants of public assistance had been made during a selected period of the fiscal year by state and local agencies administering public assistance under the Social Security Act. The total number of persons in households benefiting from grants in this selected sample was approximately 1,100,000 and the total number included in households receiving public assistance for June 1937 was slightly less than 2,000,000. The State reports have been summarized for inclusion in the Annual Report of the Social Security Board. A more complete report will be issued after January 1.

Divisions of Unemployment Compensation Research and Statistics. It is expected that by the close of 1937 all but three of the 51 states and territories will have installed the industrial classification code approved by the Social Security Board.

Data covering financial transactions have been reported since August, and coverage of workers, total wages subject to contributions, amount of contributions received, and other items have been reported by a majority of the states since October. These data are now reported as state-wide summaries. Beginning with the month of July 1938, all these items, with the exception of data on financial transactions, will be reported on an industry basis.

Monthly data on benefits will be reported by those states paying benefits beginning with January 1938. It is expected that reports will cover claims for benefits, promptness of benefit payments, the number of individuals for whom benefit checks were written, the number and amount of weekly benefit checks, and benefit terminations. The data on number of individuals for whom benefit checks were written and the number and amount of weekly benefit checks will be reported on an industry basis beginning with July 1938. The first reports, which will cover the first six months of 1938, will show the distribution of workers whose benefits were terminated, according to compensated weeks of unemployment, and the distribution of the amount of benefit payments and number of benefit checks according to benefit rates. Beginning with the month of July 1938, it is planned that data will be reported monthly showing the distribution of workers according to weeks of unemployment for which benefit checks were written.

Division of Old-Age Benefits Studies. It is expected that the data which result from the operation of the Old-Age Benefit titles of the Act will throw new light on questions concerning variations of wage rates between industries, regions, and types of communities, with respect to age groups and other characteristics of the covered population. Although the more important series which bear on wages and employment of the covered population will not be available for some time, there are already some figures which indicate the main characteristic of the major portion of industrial population of this country. Two large samples have already been compiled and are being analyzed. One of these comprises approximately 11½ million persons and results from enumeration of employee applications for social security account numbers. This sample has already been analyzed to show age, sex, and race. The data have been tabulated by regions with various sub-classifications, and will eventually be shown on a state basis.

Some analysis of the claims already certified in connection with those covered persons who have reached 65 years of age or who have died prior to becoming 65 has been made, to see what wages are earned by such persons and to determine whether there is a large amount of migration in this group. These figures, although based so far on a very short period of observation, are preliminary to later studies which will show more significant results.

Probably the most valuable type of material which will come from the Old-Age Benefit provisions of the Act will be that bearing on quarterly, annual, and accumulated lifetime earnings. Indirectly this material will give some information with regard to certain aspects of employment, such as place, continuity, and industry, by age groups.

DIVISION OF SOCIAL RESEARCH, WORKS PROGRESS ADMINISTRATION.—*Separations Study.* A study of separations of workers from WPA employment in the period April through July 1937, similar to the separations study made last year, is being conducted in nine areas. The study is intended to determine the extent and character of private employment held by workers separated from the WPA, the characteristics of separated cases, and the amounts and sources of income received by such cases before and after separation.

Personal History Study. A detailed study of a small number of cases now in the field is designed to supplement the Division's statistical information with an intimate story of the people on relief, their reactions toward being unemployed, their attitudes toward relief, and their outlook for the future.

Survey of the Transient and Homeless Population. A re-survey of the transient problem has been conducted in six of the twelve cities studied in September 1935 and September 1936, covering the same points treated in the earlier studies.

Project Procedures. The Procedures Writing Section of the Division, which plans and prepares procedures for various local research projects, has recently prepared three procedures that should be of particular value to agencies interested in case work, housing, and allied problems. A technical circular, "Study of Resident Family Migration and Occupancy in Urban Areas," was prepared as a guide to the use of population materials contained in city directories. In addition to trends and rates of change of residence of families within the city, changes in occupancy of structures can be established. Technical circulars are also ready for two projects that will supplement the information secured from city directories: "A Central File of Basic Population Data" and "Index and Annotated Bibliography of Basic Social Data."

Sampling in the Field of Rural Relief. The Rural Section of the Division of Social Research has set up a county file of basic data. A card for each county in the United States contains some twenty social and economic indices, such as type of agriculture, vital non-agricultural industries, population type, standards of living index, average farm income, and relief intensity. The file will provide a test of the representativeness of selected counties, determine the comparative homogeneity of the several areas, delineate sub-areas within major agricultural areas, and indicate the minimum number of sample counties that can be considered as a reliable sample of rural United States or of given areas.

Releases of the WPA Division of Social Research. "Part-Time Farming in the Southeast," Research Monograph IX, by R. H. Allen, L. S. Cottrell, Jr., W. W. Troxell, Harriet L. Herring, and A. D. Edwards, is a detailed study of the farming activities of 1,113 industrial workers in five major industrial areas of Alabama, Georgia, and South Carolina. It includes an appraisal of the possible efficacy of part-time farming as a means of improving living conditions and of increasing economic security.

In response to many requests for an early release of results of the cost-of-living study made in 59 cities, the Division has issued a preliminary report, "Intercity Differences in Costs of Living in March 1935, 59 Cities," by Margaret Loomis Stecker, who supervised the study and analyzed the data. A printed report including charts, tables, and budget data omitted in the present mimeographed edition will soon be released.

Other publications released are: *A survey of the transient and homeless population in 12 cities, Social service division staffs of the state Emergency Relief Administrations, 1935 and 1936* and *Relief and rehabilitation in the drought areas.*

DIVISION OF RESEARCH, STATISTICS AND RECORDS, WORKS PROGRESS ADMINISTRATION.—The Division of Research, Statistics and Records has recently prepared a catalogue of its publications.

An issue of the Report on Progress of the Works Program is being prepared for release at the end of the year. This report, like the last issue (June 1937), will present in broad perspective the operations of the Works Program with particular reference to the WPA activities.

Works Program Statistics. Particular interest at this time attaches to a report on physical accomplishment on WPA and NYA projects now in preparation. This is a summary of activities carried out on each project, covering work in progress as well as work completed, with over 200 types of project work listed on the report form. Such items as the following illustrate the varied kinds of accomplishments that are included: the number, the total square feet of floor and the total pupil capacity of schools built; the number and the capacity of storage tanks, reservoirs, and cisterns built; the number of classes in art instruction held and the number of different persons receiving such instruction, etc. Representing an extension and refinement of a similar report made as of September 15, 1936, the physical accomplishment report will, in the future, be filled out for all completed projects as they are finished so that a periodic inventory of work can be obtained by securing current accomplishment reports for active projects alone.

A recent special study concerns the work carried out under the WPA Recreation Program. Forms have been filled out in the field for each recreation project worker. Among other things the survey covered the distribution of hours of work during a particular week in accordance with various types of recreation activities, kinds of recreational facilities used, and types of agencies making the recreation sites available. An analysis of the age of participants in the various recreational activities is also included. The study affords detailed information on this important program in each state.

The Division has recently published two reports prepared in the Section on Labor Research. The first, "Local Wage Rates for Selected Occupations in Public and Private Construction, 1936," presents extensive tabulations of hourly wage rates paid in public and private construction for 25 occupational groups during 1936. The data, which represent wage rates set by various Federal agencies as prevailing in each community and also rates paid in private industry, cover approximately 1,000 different localities in the United States. The second report, entitled "The Efficiency of Skilled Workers on Works Progress Administration Projects," presents the results of a study of the qualifications of workers assigned to the tasks of brick and stone masons, carpenters, and painters on WPA projects in January 1937. The study was carried on by the WPA with the cooperation of three international trade unions. It shows the results of an investigation of both the quality and quantity of work turned out by all WPA workers in the three crafts in the cities of Baltimore, Birmingham, Hartford, Memphis, Minneapolis, Scranton, and Toledo.

The revised report of the Construction Statistics Section covering public and private expenditures and employment in the construction industry has been published under the title "Construction Expenditures and Employment 1925–1936."

Relief Statistics. On the basis of optional reports submitted by State Emergency Relief Administrations detailed tabulations showing by types of project the number and cost of Emergency Work Relief Program projects have been prepared and published for 10 states. A preliminary summary for the Continental United States is nearing completion.

A revised statistical summary of emergency relief activities for the period January 1933 through December 1935 is being prepared. This bulletin will reflect revisions of figures published in the previous summary. It will also include additional data and more explanatory material.

In accordance with an agreement between the Social Security Board and the Works Progress Administration the monthly bulletin, *General Relief Statistics*, was issued as a joint publication of the two agencies for January, February and March 1937. Copies may be obtained from the Works Progress Administration.

A monthly memorandum on the various relief and work programs is being prepared for the administrative use of WPA officials. A basic objective is the explanation and interpretation of combined data on the Works Program, the National Youth Administration, The Civilian Conservation Corps, the public assistance program of the Social Security Board, general relief, and the rural rehabilitation program of the Farm Security Administration. The first issue "Relief in the Year Ending June 30, 1937" included a summary of statistics for these programs for the year, as well as data on changes during the current month. All issues have also included brief summaries for the United States of public expenditures for various types of relief since 1933.

National Research Project. The studies undertaken by the Project on "Reemployment Opportunities and Recent Changes in Industrial Techniques" have been outlined in previous numbers of this JOURNAL, which have also included a list of publications to June 1937. By October the following additional reports had been published: *The Research Program of the National Research Project; Mechanization Trends in Metal and Nonmetal Mining as Indicated by Sales of Underground Loading Equipment; Employment and Related Statistics of Mines and Quarries, 1935: Coal; Changes in Technology and Labor Requirements in Crop Production: Sugar Beets; Changes in Farm Power and Equipment: Mechanical Cotton Picker; Summary of Study on Labor Productivity in the Leather Industry* (in the *Monthly Labor Review*, July 1937); *Summary of Study on Mechanical Changes in the Cotton-Textile Industry, 1910 to 1936* (in the *Monthly Labor Review*, August 1937). A bibliography on farm practices and the use of labor on farms is in press.

Reports which are being prepared for publication include the following, *Employment and Unemployment Experience of Cigar Workers in Manchester, New Hampshire, Employment and Unemployment Experience of Coal Miners in West Virginia, Philadelphia Textile Workers—A Study in Irregular Employment and Its Social Consequences, Changes in Labor Productivity in the Manufacture of Beet Sugar, Changes in Job Requirements of Manufacturing Plants in Minnesota, Changes in Farm Power and Equipment: Farm Tractors, Changes in Technology and Labor Requirements in Crop Production: Corn,* and *Changes in Efficiency of Fuel Consumption in the Cement Industry.*

NATIONAL BUREAU OF ECONOMIC RESEARCH.—Four *Bulletins* have been published recently: Non-Farm Residential Construction, 1920–1936, by David L. Wickens and Ray R. Foster; National Income, 1919–1935, by Simon Kuznets; Technical Progress and Agricultural Depression, by Eugen Altschul and Frederick Strauss; Union Membership in England and the United States, by Leo Wolman.

The first volume of *Studies in Income*, containing papers presented at the 1936 annual meetings of the American Statistical and Economic Associations and at the January 1937 meeting of the Conference on Research in National Income and Wealth has also been published by the National Bureau. Two volumes by Simon Kuznets are in press: *National Income and Capital For-*

mation is a small monograph containing the summary figures, 1919–35; *Commodity Flow and Capital Formation* will contain the basic tables of the capital formation study together with a complete description of source materials.

Leo Wolman is on sabbatical leave from Columbia University to devote himself to writing a volume, for the National Bureau, on work and wages in the United States.

The Committee on Fiscal Policy, appointed in June by the National Bureau to further its cooperative program, has met twice. As soon as funds can be secured, a survey of material on the impact of the governmental fiscal system on the economy as a whole will be made with a view to laying out projects that should be undertaken to supplement the available data.

THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.—The Station has just published Bulletin No. 309, "Recent Changes in the Social and Economic Status of North Carolina Farm Families," by C. Horace Hamilton, who is now with the Texas Agricultural Experiment Station. This bulletin is based on studies of approximately 3,500 rural families in seven North Carolina counties. General subjects covered by the bulletin are changes in farm tenure status, the agricultural ladder, changes in crop acreages and incomes, population composition and characteristics, trends in marriages, births, and migration, and trends in educational status. The above subjects are analyzed in relation to farm tenure and color.

Copies of the bulletin may be obtained free of charge from the North Carolina Agricultural Experiment Station, State College Station, Raleigh, North Carolina.

RESEARCH PROJECTS AT DUN & BRADSTREET, INC.—*The 1937 Retail Survey*, almost identical in form and coverage with the 1936 work, was completed in July, about six weeks earlier than was the case last year. It was based on operating statements received from 26,000 concerns, and covered somewhat over one hundred retail trades giving typical operating ratios such as gross margin, inventory turnover, expenses in detail and totals, operating profit, sales trends, inventory trends, and proportions of cash, credit and installment business. In those trades where the sample of reporting concerns was large enough to permit, additional breakdowns by size of store, size of town, and geographical territory were published.

The only significant change from last year's Survey was a refinement of the method of classifying concerns by trades. Many peculiar combinations are found involving in a single store what seem like two distinct lines of retail business. By obtaining the percentage of sales volume in each of the three major lines carried by any store, it was possible this year to classify each concern according to its major line, or if a considerable number of concerns reported the same combination of lines not dominated by any one group of commodities, a special combination trade was designated. The figures were tabulated separately as a group.

Most of the changes in expense and margin ratios between 1936 and 1937 experience were slight and were in the direction which would be expected as a result of increased prosperity and business volume. It is believed that an interesting statistical study could be made of the extent and character of these variations. This has not been possible because of the pressure of other work in the Dun & Bradstreet organization. The idea is suggested here for any interested explorer.

An Appraisal of the Undistributed Profits Tax. This study was the combined result of: (a) An impartial study of the form of the tax, based largely on government data, published comments and a careful weighing of the sources and natural bias of all material used, and (b) a special questionnaire mailed out to leading firms of certified public accountants and returned by over 700 corporations.

The statistical tables were mainly in the form of tallies of answers to specific questions. Frequency distributions were made of percentages given in answers to such questions as were framed to determine the proportion of earnings paid out in dividends before and after the tax. Two-way frequency distributions of some of these tallied answers were used to show trend of policy as influenced by the tax.

Surveys of Wholesalers' Operating Costs were released the third week in October for the following trades:

Name of trade	Number concerns reporting
Wholesale grocers	124
Automotive and equipment wholesalers	154
Dry goods wholesalers	72
Confectionery wholesalers	180
Bakers and confectioners supply houses	24
Floor covering wholesalers	30
Paint and varnish wholesalers	48

Each of the surveys was conducted in cooperation with a national association of wholesalers or manufacturers interested in that trade. The experience of the Department of Commerce as well as the Dun & Bradstreet office, plus the observations of practical business men suggested three basic propositions which were given special attention in planning the questionnaires and the tabulations:

(a) Inasmuch as the prevailing margins on different lines of goods vary widely within a single wholesale trade, differences in the major lines of goods featured by the several reporting wholesalers would cause variations in the annual operating margins and expense ratios.

(b) That it costs more to serve certain types of the wholesalers' customers than other types and, therefore, wholesalers who have developed a major bloc of sales volume among specific customer groups will be likely to record appropriate differences in their operating experience.

(c) In addition to the separation of profitable and losing concerns in such an analysis, those concerns earning less than a reasonable return on net worth should be separated and studied as a "survival" group distinct from the "successful" group, earning enough return on their net worth to encourage the owners in the investment of additional capital.

Thus, wholesale grocers carrying a substantial quantity of perishable merchandise are analyzed separately. Automotive parts and accessories wholesalers selling primarily to retail accessory stores are distinguished from those doing most of their business with garages and service stations. The survival group of dry goods concerns attribute their small profit mainly to their failure to obtain an adequate margin, while the trouble with the losing concerns was almost entirely a matter of expense.

A Revised Insolvency Index computed back to 1887 will appear in the December issue of *Dun's Review*. The revision involved checking all known possible sources of inaccuracy in the original data, particularly a regrouping of figures which were reported in earlier years on periods of four or five weeks to conform to a calendar month basis. A seasonally adjusted series will be published parallel to the index.

THE PSYCHOMETRIC SOCIETY.—The Psychometric Society held its annual meeting on September 1, 1937, at Minneapolis, Minnesota, in conjunction with the American Psychological Association. A separate program of six papers on rational-quantitative psychology was presented.

At the annual business meeting presided over by President Edward Lee Thorndike, it was announced that Dr. J. P. Guilford of the University of Nebraska was elected President of the Society for 1937–38. Drs. Milton Metfessel of the University of Southern California and Karl F. Muenzinger of the University of Colorado were elected directors for the term 1937–38. At the dinner meeting held in Minnesota Union, Dr. E. L. Thorndike delivered the Presidential address, the title of which was "Psychometric Methods Applied to Sociological Data."

THE SOCIAL SCIENCE RESEARCH COUNCIL.—A series of research monographs on Social Aspects of the Depression has been prepared under the general guidance of the Committee on Social Aspects of the Depression under the chairmanship of Professor William F. Ogburn of the University of Chicago. Other members of the Committee are: Dr. Shelby M. Harrison of the Russell Sage Foundation and Professor Malcolm M. Willey of the University of Minnesota. Professor Samuel A. Stouffer of the University of Chicago served as Director of Studies.

These monographs were prepared by a number of authors, each of whom examined critically the literature on the impact of the depression in his field for the purpose of (1) locating existing data and interpretations already well-established, (2) discovering serious inadequacies in information, and (3) formulating research problems feasible for study. The purpose of the monographs was not to provide answers to any research questions but rather to formulate fruitful questions for research to suggest the kinds of data that are available and the modes of attack which are most promising and otherwise to aid and stimulate research in this phase of social science.

The series includes *Crime* by Thorsten Sellin; *Education* by The Educational Policies Commission; *The Family* by Samuel A. Stouffer and Paul F. Lazarsfeld with the assistance of A. J. Jaffe; *Internal Migration* by Warren S. Thompson; *Minority Peoples* by Donald Young; *Social Aspects of Reading* by Douglas Waples; *Recreation* by Jesse F. Steiner; *Religion* by Samuel C. Kincheloe; *Rural Life* by Dwight Sanderson; *Social Aspects of Consumption* by Roland S. Vaile with the assistance of Helen G. Canoyer; *Social Aspects of Health* by Selwyn D. Collins and Clark Tibbitts; *Social Aspects of Relief Policies* by R. Clyde White and Mary K. White; and *Social Work* by F. Stuart Chapin and Stuart A. Queen.

The monographs are being distributed by the Social Science Research Council at one dollar each or ten dollars for the complete set.

CHAPTER ACTIVITIES

The Albany Chapter.—The Albany Chapter held a dinner meeting on October 1, with F. J. Decker, President, in the chair. Forty-six members and guests were present. Dr. I. A. Hampt of the New York State Department of Civil Service, who was the principal speaker, gave a talk on the general purposes of job classification and salary scale standardization. C. C. Dubaur outlined the report of the Committee on Statistical Positions which was submitted to the Standardization Board.

Announcement was made of the nomination and election by the Executive Committee of Miss Mildred Lauder of the Department of Labor as Secretary of the Chapter. The action of the Executive Committee was confirmed by the membership.

The Cleveland Chapter.—The first meeting of the Business Statistics Section of the Cleveland Chapter for the present season was held on September 27. The meeting was devoted to a forecast of the index of industrial production of the Board of Governors of the Federal Reserve System for the next twelve months. Ten members presented forecasts and each one attempted to justify his forecast. The composite was fairly optimistic since no one projected a major recession in industrial activity. The forecast for July 1938, ranged from a low of 108 to a high of 128. The low of the composite was reached in January at 109. No member projected the index below 99. Twenty members and guests were present.

Mr. L. M. Whittington of The Cleveland Trust Company was chosen as chairman and Mr. W. T. Diebold of The Ohio Bell Telephone Company was chosen as Secretary for the coming year. A note of thanks was expressed for the splendid work done by Mrs. Frida F. Selbert of The National Machine Tool Builders Association as Chairman during the past year.

The New York District Chapter.—A meeting of the New York District Chapter was held on Tuesday evening, September 28, at the Hotel Governor Clinton. The general topic for the evening was "The Outlook for Inflation, Business, and Security Prices." Donald R. Belcher, Assistant Chief Statistician of the American Telephone and Telegraph Company and a Vice-President of the American Statistical Association, presided. The addresses presented by three speakers are summarized in the following paragraphs.

The first speaker was Dr. Willard L. Thorp, Director of Economic Research, Dun and Bradstreet, Incorporated, who spoke on "Inventories as a Business Forecaster."

Business activity is the flow of goods, while inventories represent stoppages in this flow. They are particularly significant in that they focus attention on viscosity at various points along the economic process. A complete discussion of inventories would have to extend all the way from natural resources to goods in the hands of consumers. It should cover deferred services which can be used only over a period of time, taking the form of consumers' durable goods, real property, or productive equipment. However, limiting the discussion to inventories at the more usual points, some idea of the scope of the problem can be obtained by rough estimates, as of the end of 1935, that manufacturing inventory was about $9.7 billions; wholesalers' inventory, about $2.5 billions; and retailers' inventory, $4.3 billions; a total of $16.5 billions. However, it should be noted that manufacturing inventory is made up largely of goods in the process of production, so the total finished goods' inventory would probably be nearer $10 billions.

The importance of inventories in the economic picture varies tremendously from industry to industry. One indicator of this importance is the turn-over rate, which is a way of measuring the length of time it would take to liquidate the inventories on hand. Furthermore, an examination of certain specific retail trades shows that changes in inventories are not uniform but may vary according to size groups within the trade. During 1936, for example, the furniture trade showed greatest inventory increases in the largest stores, while the women's ready-to-wear trade showed them in the smallest.

In judging changes in inventories it must be remembered that certain variations are almost automatic, arising from such causes as changing sales volume, seasonal fluctuations, or the lag required before production schedules can be changed. In addition to these considerations, there is an extremely close relationship between inventories and prices, the two tending to advance or decline together. Also, inventory changes are dependent upon the current state of psychology, since that inevitably involves the creation or deflation of commodity speculation in inventory form. Not only are inventories the result of other economic factors, but they in turn can have an important effect upon the volume of production and the behavior of prices.

At the present time, the data available for judging inventories are extremely scanty. Nevertheless, taking the data from many sources, it appears that increases in inventories in 1935 and in 1936 were in general less than increases in sales. During 1937 there has been increasing talk about high inventories, largely the result of the nature of the statistical evidence. In 1936 the great increase in inventories came in the last few months of the year. Although inventories in 1937 seem to have reached their peak about March, they still show a high percentage gained over a year ago, because of the low state of inventories in the early months of 1936. At the present time inventories seem to have about their normal relationship to sales and the forgotten point is that in the summer of 1936 they were extraordinarily low. In fact, this low inventory condition contributed greatly to the boom of the late months in the year.

Professor O. M. W. Sprague of Harvard University spoke on "Why Inflation is Not Imminent."[1] We have not had inflation yet, if we mean by inflation a rapid and extreme advance in commodity prices. The advances since

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[1] Professor Sprague's address was printed in the *Annalist* for October 8, 1937.

1932 are those which always accompany recovery following extreme depression. Although extraordinary increases in monetary gold will eventually increase prices, the mere increase is not sufficient unless the gold is inadequate at the time of increase. With adequate gold, further increases remain dormant until there is intense demand for additional currency and credit, taking the form of expanding bank loans and investments.

Easy money policies have not been sufficient to induce a generally large increase in demand for bank credit. The government has been the only large-scale borrower, but its borrowings and deficits have not been sufficiently great to produce price advances. Government credit has been strong, and therefore there has been no flight from money into commodities, creating "fear" inflation. The possibility of such "fear" inflation is remote. If there is to be inflation, it must result from an intense demand for all sorts of labor and materials, supported by rapidly expanding bank loans. This cannot be produced by increasing the purchasing power of consumers with small incomes. Since people save money and seek to invest it, there must be commensurate capital investment if there is to be widespread demand for materials and labor. Approximately three-quarters of capital investment, directly or indirectly, goes into construction. Capital investment has been small, despite easy money, largely because construction costs are high. Construction now costs 15 or 20 per cent more than it did two years ago. Costs have advanced well before capacity production in construction has developed, rather than as a result of intense demand. These increased costs seem to be the principal obstacle to more active business with the attendant but distant danger of inflation.

In Great Britain an easy money policy and lower construction costs resulted in a vast increase in employment mainly in the construction of houses. In the recovery Great Britain got something of enormous value to the mass of the people.

Business recovery depends upon business pricing policies more than upon Washington's policies. The most effective lifting of living standards is through reduction in prices of things having elastic demand. In Great Britain brick prices were reduced three times between 1932 and 1935. In this country they have advanced, but nobody maintains that demand for them is in excess of brickmaking capacity.

Hasty price increases are inappropriate to situations where there are technological improvements. Such improvements produce unemployment, unless prices be lowered and outputs increased. So long as prices are maintained by advertising or otherwise, there is no danger of inflation, but there is also little likelihood of attaining maximum production and full employment. Greater inflation danger is preferable since that can be controlled, but it is questionable that a democratic country can successfully handle chronic unemployment. Chronic unemployment, resulting from rigidity of prices, prevailed before this Administration came into power. At that time it was said reduction in construction costs would not induce a demand. During the past two years, however, such reductions would have increased demand. Instead of reductions there have been increases. Government appropriations for housing, unless administered so as to reduce unit costs, will help only those people fortunate enough to secure places in the houses the Government assists in building. Both Washington and business need to see the advantage of reducing prices where there are many technological improvements, and where there is an elastic demand. Under the circumstances, I feel very confident that inflation is not imminent.

James F. Hughes, Market Analyst, Charles D. Barney and Company, discussed "The Future of Security Prices."[2] Sometime between now and February, 1938, there will be a fair intermediate recovery in stock prices. The period between now and then is considered exactly analogous to the period from October, 1923, to the spring of 1924.

Beyond the Spring of 1938 there are three possibilities which might be termed, "The Tragic Retribution of Economic Justice," "The Compromise of Practical Politics," and "Realistic Economic Statesmanship." Under the first possibility market prices will continue downward the greater part of 1938 as a result of a continued deflation in bank credit. This could come about through a liquidation of the swollen investments of banks largely in government bonds. From 1933 to 1936 investments of all banks increased $10 billions—deposits increased $16 billions, but bank capital only increased $600 million. This most rapid of all increases in deposits and investment in connection with small increases in capital assets resulted, in 1936, in the highest ratio of deposits to capital ever reached. Despite this serious capital problem the monetary managers proceeded to increase by one hundred per cent the reserve requirements of member banks in order to prevent astronomical loans to a business, a policy analogous to that of 1923 and 1924. This not only checked the expansion of credit, but brought about a contraction in credit. In the presence of other discouraging factors, it seems unlikely that it will be easy to reverse the downward trend in industrial activity, commodity prices, and security prices.

The commodity price situation furnishes an even more direct analogy between 1923 and 1937, and it is believed that commodity prices, as they did in 1924, will continue to sag off in 1938. Perturbation on the part of our monetary managers, especially if the Federal Reserve Board index of production begins to flirt with one hundred next spring, raises the question whether something analogous to the handsprings of the monetary managers in 1924 will then take place.

In connection with the "Compromise of Practical Politics," a *Wall Street Journal* article may be noted: "A renewal of government spending on an emergency scale to stimulate fall and winter business activities will be urged on President Roosevelt. . . . " In the same connection Mr. Morgenthau said: "In line with talks I had with the President . . . we are looking in every direction to see where we can save money for this fiscal year." Apparently a choice has to be made before next summer.

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[2] A stenographic account of Mr. Hughes' talk was printed in the *Annalist* for October 8, 1937.

The third possibility is a starry-eyed idealist's dream, "Realistic Economic Statesmanship." This involves restoration of the balance between business and finance which prevailed before the advent of scientific credit management. When this balance existed, most of the "bull" markets occurred when business was below normal, and "bear" markets occurred when business was above statistical normal. Panics and little "bear" markets normally were completed before business became depressed. A new era like that we had in 1929 never occurred before the days of scientific credit management. It is suggested that our managers try to restore the old-fashioned balance. When business is below normal speculation might be encouraged. Certainly the creation of new capital for corporations should be encouraged. During the past five years new corporate capital raised has amounted to $3 billions, as compared with $28 billions in the five years ending in 1929. We certainly need more now than $3 billions. If it is not obtained, there will be a slow drift towards inflation. We have been drifting that way for five years with no realistic concept of what makes prosperity or depression.

In 1938 we will be struggling with problems involving business activity, commodity prices and the stock market. My guess is that we will do so on a policy of political compromise.

THE PITTSBURGH CHAPTER.—On September 30 the Pittsburgh Chapter joined with the Pittsburgh Personnel Association to hear Mr. Andrew Fraser, Jr., of the Bureau of Labor Statistics, United States Department of Labor, speak on, "A Survey of the Engineering Profession." There were fifty members present.

At a meeting of the Chapter on October 28, Mr. Bervard Nichols, Editor of the *Pittsburgh Business Review*, led a discussion on the general business situation. The discussion was participated in by the following named men who told primarily the effect of the present business conditions on their particular line of work: Mr. G. A. Doyle, Bell Telephone Company; Mr. Charles A. Carpenter, U. S. Department of Commerce; Mr. E. C. Stone, Philadelphia Company; Mr. D. H. Bulter, Economic Statistics, Inc. The meeting was very interesting, with an attendance of 36.

At this meeting the following officers were elected for the coming year: President, William R. Hamilton, West Penn Power Company; Vice-President, Frank M. Kenney, Duquesne Light Company; and Secretary-Treasurer, Ralph Fletcher, Bureau of Social Research.

THE SAN FRANCISCO CHAPTER.—At the meeting on July 22, 1937, Professor W. L. Crum of Harvard University addressed the Chapter on "The Current Situation in American Business." A summary of Dr. Crum's address follows.

The present situation in business is so complex that a brief talk can do scarcely more than present a cross section of the current picture. Forecasting and prognostication are not only unwise but most difficult in view of the existing circumstances.

There are certain peculiarities in the present situation which are very important to a statistician in interpreting trends and current levels, peculiarities which are for the most part new developments or at least appear in new forms. One of the leading problems confronting the business statistician is the labor situation. Labor disturbances are customarily incident to the early stages of a cyclical business revival, and the increased frequency of labor disturbances is qualitatively nothing new. But certain important characteristics of this labor struggle are obviously different from those we have seen before, and labor objectives are of a different sort than they have been in the past. Labor objectives have now almost a political character. We have now a development of labor power capable of being mobilized and directed like an army. This is indeed new. For the first time in many years labor has found an extremely forceful leadership; showing a capacity for a kind of drive unknown heretofore in the labor movement. Again, the suspicion prevails that the present labor drive is in some way allied with one of the political powers in the nation. These differentiating characteristics have made recent developments in labor more ominous to business management than would otherwise have been the case. Normally strikes are a natural attendant of a period of recovery following a depression, but this situation is peculiarly threatening.

The fact of a fundamentally altered currency and credit situation also distinguishes the current economic set-up. It is not inaccurate to state that never before have we had a converging of such worries as the gold problem, the possibility of more complete central bank control, and the extensive participation of the government in economic affairs. We have gold importations the magnitude of which is entirely unprecedented, the clearly formulated makings of credit management, a central bank in a truer sense than heretofore, and certainly the participation of the government in credit management on an unheard-of scale. Therefore, a new situation in credit exists which is quite beyond the reach of mere analogy with the past.

Another basic distinction between the present and the recent past is the greatly broadened activity of the government with respect to industry and finance. This recovery is a recovery under the auspices of governmental regulation on a grand scale, a governmental regulation marked by the appearance of opportunism apparently devoid of a broad outline of the kind of structure toward which it is aiming. There is some justification for the belief in certain quarters that such an outline has never existed. There is no announced and clarified philosophy of the relation of government to business. This appearance of opportunism has been one of the most disquieting threats to business management. Business can adjust itself to changed conditions, but change which is taking place spasmodically is in the highest degree disquieting to policy-forming management. This is one reason for the reluctance on the part of executives to plunge into commitments running far into the future.

The statistician who interprets the record must remember that we have very imperfect machinery with which to arrive at conclusions. We are utilizing a lame set of analogies with the past; and actuating our logical processes is the thought that the current situation resembles another, say thirty or forty years ago, and that findings concerning history give an answer to the present. There is such a thing as the unfolding of a cyclical development, but we are not now in the course of a normally unfolding business cycle, and have not been since the War. It is practically impossible to superimpose upon the current situation some earlier chunk of economic history and get a significant fit. Because the new factors are so important, we must use past analyses with a great deal of reservation and doubt.

We find frequent assertions in the financial press that business is far above normal. As a matter of fact we have no scientific basis for ascertaining what is normal, we have had no such basis since the War; and there definitely is no warrant for determining the normal by statistical methods. Another problem presents itself in the study of price movements, their classifications and bases of reference. We have classified commodities on various bases; by nature of the raw material, by manner of use, by place in the industrial world (whether they move in world trade), and by price making characteristics. Again, in the case of banking statistics, we have an instance of a new statistical difficulty in the recent re-classification of loans by the Federal Reserve Board. Loans have in the past been classified broadly on the basis of nature of the security, now they are classified according to the purpose for which the money was loaned. This is a good change, a change which could helpfully have been made twenty years ago; but, made recently, it obstructs current analysis. Likewise seasonal indices, because of changed ideas with regard to seasonal movements, are statistical tools which are rapidly becoming obsolete. Hence, some of the very factors which distinguish the current economic situation operate to destroy the aptness of our methods.

A somewhat easy interpretation of the present picture is that we are entering upon an era of general credit inflation, that numerous steps have been taken to induce such an experience; and that what has happened in security and commodity prices, expansion of bank credit for building, etc., are manifestations of an incipient inflation. We cannot prove that this is a wrong interpretation and certainly it is a possible one which no serious student can conscientiously overlook. However, making such use as we dare of past analysis, all that has happened *can* be interpreted as a fairly normal cyclical revival of the ordinary sort. The whole movement of business activity during recovery can be interpreted as a cyclical revival which has progressed perhaps half way along its route.

LEROY D. PEAVEY

Leroy D. Peavey, for fourteen years a member of the American Statistical Association and for two years (1931 and 1932) President of the Boston Chapter, died at his home in Watertown, Massachusetts, on March 25, 1937.

Mr. Peavey was born in Exeter, New Hampshire, on March 11, 1876. After graduating from Phillips-Exeter Academy, he attended Massachusetts Institute of Technology, from which he received the civil engineering degree in 1898. He secured a position with the Converse Engineering Company and remained with that company until 1910, when he became connected with the Babson Statistical Organization. Shortly afterward, he was appointed Business Manager and Vice-President of that organization, and in 1925 he became its President. He was a member of the American Economic Association and of the Executives Club of Boston and addressed many business organizations in the principal financial centers of the country. In addition to his statistical and business interests, he was an active church worker. He was a member of the General Board of the Church of the Nazarene and was Treasurer of Eastern Nazarene College for several years. His wife, one son and four daughters survive him.

ROSWELL F. PHELPS

NEW MEMBERS

Baumann, George A., Supervisor, Bureau of the Census, Department of Commerce, Washington, D. C.

Bickford, Jane M., 76 Mile Square Road, Yonkers, New York

Butterbaugh, Grant I., Associate Professor, University of Washington, 210 Commerce Hall, Seattle, Washington

Cartun, Walter P., General Electric Company, Cleveland, Ohio

Chapelle, C. C., Vice-President in charge of Research and Merchandising, H. W. Kestor and Sons Advertising Company, Incorporated, 360 North Michigan Avenue, Chicago, Illinois

Dickey, Granville E., Chief Statistician, United States Civilian Conservation Corps, New Post Office Building, Washington, D. C.

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REVIEWS

L'Equilibre dans les Relations Economiques Internationales, by Albert Aftalion. Paris: Les Editions Domat-Montchrestien. F. Loviton et Cie. 1937. 466 pp. 60 fr. Printed in French.

This volume consists of five parts in addition to an introduction and a conclusion. The first part is a critical analysis of the various theories of automatic equilibrium. The other four are a statement of positive theory, dealing successively with reequilibrium of the balance of accounts, movements of capital and movements of merchandise, equilibrium of the balance of payments, and world equilibrium of prices. The analysis is detailed, and there are unnecessary repetitions of ideas, owing apparently to the author's anxiety that under every point raised no step in the argument shall be omitted.

In the introduction, which discusses the different concepts of balance, Professor Aftalion is confronted with difficulties of terminology. The idea of the commercial balance or balance of trade is a common one and sufficiently precise for his purpose. But he wishes to draw a distinction between two other ideas for which there are no commonly accepted terms. He does it by discriminating between the balance of acounts and the balance of payments. The former sets forth the economic relations of a given country with the rest of the world for a given period, usually a year. It includes the visible and invisible items with which economists are familiar and is seldom, if ever, in strict equilibrium. There is regularly an excess or a deficit.

"Balance of payments" is a broader term, embracing everything included in the balance of accounts but also all movements of capital and of gold which do not appear in the balance of accounts, especially those which show the existence of creditor or debtor status in the balance of accounts, making necessary or indicating new capital investments. Except in cases of insolvency, the balance of payments is normally in equilibrium.

This distinction is a valuable one and runs throughout the volume. There is, in fact, as Aftalion shows, no reason for expecting equilibrium in the balance of accounts, even over an extended period of time. If the concept includes new loans and advances of all sorts, including open book accounts, short-term bills, etc., the fact of a balance is a truism. If, however, new loans and advances of all sorts are excluded, there is no reason to expect a balance, and the excess or deficit may, as he points out, continue for an indefinitely long time. The terminology is, as he realizes, awkward but the distinction is important. Although equilibrium in the balance of payments is not a reality at all times, it is nevertheless the norm toward which the economic world necessarily tends. As disequilibrium appears it sets in motion reactions which automatically bring a reequilibrium. To explain this is the purpose of the volume.

The older and the usually accepted theories of automatic equilibrium in the balance of accounts are examined and criticized as inadequate—barter, gold movements, capital movements, the rate of discount, fluctuations of the exchanges. In every case they show theoretical defects, and, besides, the balance of accounts regularly shows an excess or a deficit. There is some tendency toward equilibrium, but when it occurs the older explanations are inadequate.

Professor Aftalion's objections to many of the usual views are due to his dissatisfaction with the quantity theory of money. His own preference is for his formula $R = PQ$ in which R is income, Q is commodities and services produced, and P is the average price. Instead of finding the stimulus to change immediately in P he finds it in R or in Q. "The stimulus arises from the inequality between income or available resources and production due to the disequilibrium in the balance" (p. 449). A deficit in this balance implies a reduction in income as compared with production which reduces the capacity of the domestic market to absorb this production and leads to an increase of exports. An excess of available income over production correspondingly encourages an increase of imports. These forces, however, encounter many psychological, political, and economic factors which condition their appearance and their efficacy. When disequilibrium appears in the balance of accounts, there is no certainty that an equilibrium will be established, but merely a possibility. Deficits or excesses are persistent even over long periods of time. There is a tendency toward a world equilibrium of price, but it is due not to movements of gold or of capital and not entirely to the sale of merchandise but to other factors also, especially to the psychological. Again there is only a tendency toward an equilibrium but no certainty that it will be realized.

Since automatic influences cannot be relied upon for the maintenance or restoration of equilibrium, direction is needed in the form of intervention by the State. State policies have, in fact, been primary causes of the appearance of disequilibrium, but it is not the principle of intervention that is at fault. It is its application that has been dangerous.

Several comments may be made. Professor Aftalion has rendered a distinct service through his emphasis on the distinction between the balance of accounts and the balance of payments. Harm has been done by the careless and inaccurate contention that imports must equal exports, even when the statement is qualified by the inclusion of invisible items and references to "the long run."

Although the quantity theory of money is currently in disfavor, Professor Aftalion's analysis does not adequately dispose of it, except perhaps in its crudest form. He substitutes his favorite formula—$R = PQ$—but does not make clear just how an inequality between R and P arises. Further argument is needed to show how this inequality arises, and unregenerate adherents of the quantity theory would locate the cause on the money side of the price ratio.

Finally, it should be said that the author has rendered a further service by emphasizing the weaknesses in many theories, in stressing political and psychological as well as economic factors, and in reminding us so forcefully of the facts, including the errors, of state intervention.

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Balances of Payments 1935. Geneva: League of Nations. New York: Columbia University Press (Agents). 1937. 176 pp. $1.50.

This volume is one of the League's series on balances of international payments which have appeared annually for more than 15 years. The present issue reprints the figures compiled by 28 countries, colonies, or other areas. The corresponding number a few years ago was more than 40. There are, nevertheless, a few countries which are relative newcomers: Russia, China, Palestine, and Curaçao.

Prominent among the countries formerly reporting but not included in this symposium for 1935 are Italy, Switzerland, and Belgium; and none of the 21 Latin American Republics, of which several formerly compiled balances of payments, is now included. Though Italy's defection has a special explanation, world-wide hard times may explain the reduced number of these expensive studies. When budgets pinch, why disburse for statistics not really understood by some of the compilers themselves and ignored by the framers of international policy everywhere?

This review is made from the standpoint of methodology. Which countries are refining their estimating methods, extending the scope of their investigations, and revising their figures for earlier years? Which are discovering new invisibles? Which are "completing their stubs"—boldly entering into the prose of their tables every invisible item known to exist, however poetic the arithmetical measurement opposite it? Which are estimating by subclasses of transactions for each item: Dividing to Conquer? In brief, which countries just now are doing the balance-of-payments thinking for the rest of the world?

The Netherlands lead in the space accorded by the League editors, and none of the space is carelessly filled. There is a balance of payments for the mother country and one each for Netherland Indies, Surinam, and Curaçao; besides, there is an "inter-area" table of payments between Netherland Indies and the mother country (pp. 120–22). The Netherland stub includes such relatively new items as adjustments for diamonds, for fishery products bought from foreign vessels, and for gold sent by post. Capital transactions are broken into 14 subclasses; earmarking of gold, into 7. Yet, "owing to the incompleteness of the information available, no totals are shown" (p. 114). Where there is such evidence of integrity in compiling, it is likely that the international turnover (credit footing, plus debit footing) is within one-twentieth of unknowable absolute accuracy. Both the totals and the discrepancy due to errors should have been shown—for any of six reasons that could be cited.

France, whose Foreign Office is said "never to learn anything and never to forget anything," still dispenses with official balances of payments. The League editors printed, for France, the private study by Leonard Rist and Philippe Schwob (pp. 82–7). This scholarly study undoubtedly benefited from the admirable pioneer work of Pierre Meynial, private compiler for France for a decade or so; but the new compilers courageously adopted a longer stub more finely subdivided. An interesting feature of their own pioneering is the extending of their balance-of-payments area to encircle France and her oversea territories. Definitely, they have gone Meynial "one better."

Canada, also, may merit the highest praise. Under Dominion Statistician R. H. Coats, a trio of keen, well-trained scholars have patiently continued their investigations, repeatedly extended, constantly revised. They have in manuscript an exceedingly laborious report on balances of payments between Canada and the United States for a long series of years; this inter-area study will record the heaviest volumes of transactions between any two countries in the world.

The Latvian compiler should be watched appreciatively. His stub includes the sawing of Russian and Polish wood in transit; also, salaries of Latvian journalists and artists living abroad (two items). He has set an example for the compilers of larger areas. In my "International Transactions" I argued that compilers should build dossiers on "miniature invisibles" or miniature adjustments of large items. These tiny groups of transactions may suddenly expand to balance-of-payments dimensions and thus reward scrutiny.

For stagnant technique we might turn to the United Kingdom (pp. 149–55). Its balance of payments for 1935 appeared in the *Board of Trade Journal* for February 20, 1936; no time no effort. The nation which originated balances of payments was still able to wag along with its traditional stub of a Big Six or Big Eight items. One of these items, "net receipts from other sources" includes: receipts and outgoings on account of the sale and purchase of second-hand ships to and from other countries, emigrants' remittances, the savings of emigrants returning to the country, tourists' expenditure, diplomatic expenditure, etc.

A major handicap of balance-of-payments science may well be that its output is edited at Geneva each year by Englishmen. Like the compilers for the United Kingdom, they view their work as something static. Their earlier annual volumes necessitated some slight originality in presentation, since unchanged. Next year's volume could be made as vital as last year's, by a newspaper hack or bookkeeper. The editors take the sentient findings of dozens of compilers the world over and fit them all into the League's long preconceived report form; although there is nothing more uncertain in this growing science than how best to present its findings. The objective of the League's premature stereotyping was, of course, comparability, however specious; but the effect smacks of taxidermy.

The League would do better by reprinting the balance-of-payments tables of the various countries, just as they were originally presented—no individuality or local color lost. This would not prevent the League's drawing from them comparable data for its special tables on capital and tourist movements and for what it calls its"synoptical" table (p. 9).

The League editors fall far short of their opportunities to improve balance-of-payments work all over the world. (1) They should feature in their preface the year's discoveries of new invisibles, refinements in estimating, or novelties in analysis, interpretation, and presentation. The mere citing of the individual compilers who originated them would be a stimulus to further creative thinking; but the best of the new ideas, thus featured, might faster be adopted by other countries. (2) Anonymity is a stifling thing, bad in journalism and worse in scholarship. Realizing that balances of payments are necessarily about as individualistic as oil paintings, the editors should give both names and addresses of the compilers for each country. This would sharpen the professional pride of compilers everywhere; further, it would facilitate technical correspondence between compilers. (3) The alphabetical listing of countries should be broken into two or perhaps three alphabetical listings, depending upon the completeness of stubs. This rough grading by quality would become a stimulus to the numerous third-rate compilers to work themselves out of their present class.

There are some minor defects in this volume. Failure to indicate the foreign-currency equivalent of a money like the Siamese baht is one. Deadness of style, so often associated with stagnancy of thought, is another. "Total amount," used many times, is worse than dead; and so is "in that connection it might be interesting to note that" (p. 21). English editors may be pardoned for supposing that a billion is a million millions and adopting "milliard," but American readers can likewise be pardoned a condescending amusement.

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National Income and Outlay, by Colin Clark. London: Macmillan and Company, Ltd., 1937. xix, 304 pp. $4.50.

In Mr. Clark's opinion, with which the reviewer concurs, studies of national income and outlay constitute the most fertile and most important segment of the entire field of statistical studies related to economics. This is because nearly all the propositions of economic science are concerned with statements about the national income, and the whole purpose of economic study is to discover methods which will (1) increase the average national dividend, (2) regularize its flow through time, and (3) equalize its distribution among persons.

This conception of the significance of national income measurements permeates *National Income and Outlay*. The topics treated by Mr. Clark and the conclusions which he draws from his estimates are designed, by showing what the facts are and how they have come to be what they are, to aid in attaining the threefold objective of economic study. The phases of national income and outlay which Mr. Clark covers include the amount of the national income each year 1924–35, its primary distribution among factors of production and among persons and its redistribution through taxation, its utilization for consumption and for investment, adjustment for price changes and the amount of "real income," quarterly indexes of national income adjusted for seasonal variations, comparison of the national income in 1934 with that in 1688, sources of the national income, changes in consumption and in investment during the 1929-36 cycle, capital accumulation and its relation to the national income, and, finally, the rate of economic progress as indicated by long-term trends in income per capita.

After stating that the *national dividend* (a term which is used interchangeably with *national income*) must always be conceived in real, but measured in money terms, Mr. Clark defines the national dividend as follows:

> The national dividend may be defined for any period as those goods and services which flow into being during that period which are customarily exchanged for money, avoiding, of course, double reckoning of those goods and services which are produced at one stage but then used up again in another stage of the productive process. We require a net total of the value of goods and services available for consumption or investment.

This definition is virtually identical with definitions given by King, Kuznets, Leven, and other American writers on national income. Mr. Clark interprets the definition, however, to include an evaluation of one important class of services which has been uniformly excluded by national income investigators in the United States. This item is the cost of services supplied free by government. Mr. Clark defends the inclusion of the value of governmental services as follows:

> Modern economists in every case now include the value of such services in the national dividend. It is clearly absurd that the services provided by a school or a water-system should be reckoned as part of the national dividend if they are run as commercial concerns, but should cease to be so reckoned if they are taken over by the State or municipality.
>
> . . . Of the services provided by public enterprise, those which are sold in the market (e.g. postal services, municipal trading services) will similarly be reckoned in at the prices at which they are actually sold; others, such as public health services or free education, must be reckoned in at cost price . . . These distinctions are not a mere pedantic necessity, for in many communities a substantial proportion of the national dividend is provided by communal enterprise.
>
> Returning to our criterion of "customary exchangeability," we may reasonably regard services rendered by public authorities as exchangeable for money, either in the form of rates or taxes, or directly.

Mr. Clark also includes in the national dividend the rental value of houses occupied by their owners but makes no allowance for imputed income from other types of goods owned and directly used by consumers. He states:

> The utility which a private individual derives from his own stock of goods, clothes, furniture, crockery, motor-car and the like, is not customarily exchangeable for money. On the other hand, the leasing of houses is certainly a customary form of exchange, and if a man occupies a house which he himself owns, we should regard the annual value of the house, as indeed do the British income-tax authorities, as part of his income. By the same token we must define dwelling-houses as capital in that they will produce real income or dividend in the future, while denying the appellation of capital to private motor-cars, furniture and the like.

Four methods of measuring various components of the national income are utilized by Mr. Clark: incomes received by individuals or on their behalf by business enterprises and governments; incomes paid out by types; net value of output of the major divisions of the economy; and expenditures upon consumption and capital expansion. His chief estimate of the amount of the national income, covering each year of the period (1924–33) with preliminary estimates for 1934 and 1935), is based for the most part upon incomes received by individuals, inserting, however, the net product of agriculture as the income of persons engaged in agriculture. The components of this basic estimate are as follows:

> Incomes subject to income tax assessment, including incomes of persons, incomes of charitable and similar organizations, and undistributed profits of joint-stock companies;
>
> Incomes of wage-earners, obtained in part from census statistics and in part from estimates of the number of wage-earners and of average annual earnings;
>
> Agricultural income, taken as the net value of output of agriculture, deducting wages of agricultural workers;
>
> Earned and property income of persons not wage-earners or farmers and not subject to income-tax assessment, earned income being estimated from the numbers and average annual earnings of salaried persons and of independent workers, respectively;
>
> Governmental income from services sold, net balance of inter-governmental transactions, and indirect taxes, deducting interest on the internal national debt;
>
> Maintenance and depreciation allowances of business concerns (included in gross but excluded from net national income); and
>
> Income due to foreigners, to be deducted.

The chief difference between this method and that followed by the National Bureau of Economic Research and the Department of Commerce in estimating national income in the United States lies in the inclusion of governmental revenues. This is made necessary by the inclusion, in the definition of the national dividend, of the cost of governmental services supplied free to the public. Mr. Clark comments as follows on the effect of this procedure in estimating the amount of the national income.

> At first sight it seems absurd that a Government, by increasing indirect taxation, should be able to increase the national income. But we must reflect that the effect of all indirect taxation is calculated to be a corresponding rise in the price of the articles or services taxed. Real national income is calculated by dividing the money national income by an appropriate price index, and this price index is bound to incorporate the effects of changes in national and local indirect taxation. Looking at it another way, the State and local authorities may be regarded as entering into certain trades as a gigantic monopolist, and the price of goods to the consumer is enhanced thereby. If a private company obtain a monopoly of any commodity and make big profits on it, we include these profits in the national income, pointing out, however, the high price of the commodity in question when we come to consider the effect of the monopolist's action on real income. Exactly the same treatment can logically be applied to the revenue drawn by the State and local authorities from indirect taxation.

The probability that a portion of governmental revenues from taxes other than income taxes is not passed on to consumers in the form of higher prices but results in a diminished money income of company stockholders, individual business proprietors and owners of rented property, and thus represents a direct transfer of income from individuals as such to the government as a collective agent for the people of the nation, is not mentioned by Mr. Clark. This, in the reviewer's opinion, is an additional important reason for treating the problem of governmental revenues by Mr. Clark's method rather than by the method used in the United States.

Even Mr. Clark, however, is not completely consistent in his treatment of governmental revenues and expenditures. He takes them into his calculations in his basic estimate of the total national dividend and also in an analysis of the distribution of the product of industry among factors of production and of its partial redistribution through taxation. On the other hand, in an analysis of the national outlay for consumptive purposes in 1932 he deducts indirect taxation incorporated in selling values—a procedure which departs from the point of view described in the quotation above comparing price advances due to indirect taxation with those due to monopolistic action. He also omits indirect taxation when calculating the net value of output of the major divisions of the economy in 1911, 1924, 1930, and 1934. Consistency with the procedure in the basic estimate requires that indirect taxes be considered a part of the net value of the product of the industry on which they are imposed. If Mr. Clark's analogy of a monopolist is carried a little farther, the government may be regarded as a favored party to whom debentures, without voting privileges but with a prior claim upon a portion of the selling value of the product, have been issued.

Detailed comparison of the statistical techniques and methodology used by Mr. Clark with those used by national income estimators in the United States is impossible. In both countries the basic data consist largely of statistics collected in connection with taxation, population and industry censuses and, in Great Britain, social insurance administration. Mr. Clark has not made as much use of sample studies of family incomes and expenditures or industrial wage and income distributions as have American investigators. His calculations and his methods of interpolation of data available only in certain years are, on the whole, simpler and subjected to fewer refinements than those utilized by American investigators, and his estimates are for this reason probably less sensitive to year-to-year changes than estimates of national income in the United States. This may be due in part to the fact that Mr. Clark has been dependent upon his own resources and has therefore not been able to obtain as much assistance as American investigators for detailed analyses of specific problems.

On the other hand, Mr. Clark's study is far more comprehensive than any single American publication, and he shows a more thorough grasp than do American writers on national income and outlay of the economic significance and interrelations of the data with which he is dealing. In this respect his book is far superior to the publications of The Brookings Institution, *America's Capacity to Consume*, *The Formation of Capital*, and *Income and Economic Progress*, which are the American books most comparable in scope.

American readers of *National Income and Outlay* who are primarily interested in Mr. Clark's concepts and results are likely to be irritated by the insertion in the text of details regarding sources and mode of making calculations which in an American publication would be placed in an appendix, or at least gathered together in tabular form. This difficulty of style, however, is in part offset by an excellent 9-page summary, at the beginning of the book, giving the conclusions of each chapter. The student who is interested in tracing in detail specific sources and methods of calculation will also be irritated by the lack of page references to the sources used and by the absence of many of the necessary details of computation.

Mr. Clark's estimates indicate that the net national income of Great Britain (including northern Ireland) in 1934 was only 3 per cent less than in 1929. The figure in 1932 was about 12 per cent lower than in 1929. Comparison with the national income of the United States is difficult because of varying exchange rates and because of the difference in inclusiveness of the figures as compared with those published in the United States. If Mr. Clark's figures for 1929 and for 1934 are converted into dollars at the average rates of exchange during those years, respectively, the net national income in both years was equivalent to $21 billion. This may be compared with figures of approximately $92 billion and $60 billion in the United States for 1929 and 1934, respectively, if the Department of Commerce estimates are raised to include governmental income from indirect taxation and from services sold. Reduced to a per capita basis the figures amount, approximately, to $465 for Great Britain and $755 for the United States in 1929, and to $460 for Great Britain and $475 for the United States in 1934.

About three-fifths of the British national income is received in the form of wages or salaries, including pensions and social insurance benefits, and about two-fifths as income from property, including profits, interest, rents, and all net income from overseas. Income from property is a somewhat larger percentage of the national income in Great Britain than in the United States. Despite this fact, however, in 1929 the national income in Great Britain was apparently distributed among individuals with slightly less inequality than in the United States. Comparison of the distribution curves of the two countries in 1934, when the average per capita income was nearly the same in the two countries, would be much more interesting and significant, but in neither country are distributions of personal incomes for that year available.

About half of the national income in Great Britain is derived from industry (manufacturing, mining, and construction), if indirect taxes are considered to be a part of the income drawn from industry, as compared with approximately one-third in the United States, computed on the same basis. The difference is due to the relatively greater importance of agriculture, financial institutions, and educational, recreational, and other services in the United States.

In 1932 approximately one-fourth of the national income of Great Britain was absorbed in the purchase of food, another fourth was used for dwelling-rents and various types of services, and a somewhat larger amount for retail purchases other than of food. Only about 3 per cent, including government expenditures for capital items, was devoted to capital expansion. Whether much difference exists between Great Britain and the United States in regard to the proportions of the national income spent for such major categories as food, home maintenance, clothing and personal care, other living, and capital expansion cannot be determined, since estimates are not available for both countries for the same year, and the differences between 1929 and 1932 appear to have been very great in both countries.

Perhaps the most interesting of Mr. Clark's conclusions relate to the accumulation of capital and the relation of such accumulation to economic progress. In 1929 and also in 1935 capital accumulation amounted to approximately 7 per cent of the national income, in comparison with about 10 per cent in the United States in 1929. The funds for capital expansion in Great Britain are obtained from undistributed profits of business concerns, savings for security by the working and middle classes, and local governments. Large private incomes are used wholly for consumption and have ceased to be a source of capital funds. Further, the rate of economic progress is not dependent upon the rate of capital accumulation. The replacement of obsolete capital by more efficient equipment, utilizing funds from depreciation allowances, appears to be the primary factor responsible for a rapid increase of productivity and a rapid rise in the standard of living of the population of Great Britain during recent years. The proportion of income saved and the amount of capital invested appear to be effects, rather than causes, of the changes associated with economic progress.

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Income Received in the Various States 1929–1935, by John A. Slaughter. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies Number 234. May, 1937. xv, 167 pp. $3.50.

This work resembles somewhat the earlier efforts of Knauth and Leven in preparing state income estimates, but can more appropriately be described as a geographic apportionment of the national income estimates slightly revised from those recently published by the National Industrial Conference Board in Robert F. Martin's book, *National Income and Its Elements.* No new concepts are introduced or discussed, and the entire text, tables, and appendix relate to the methods of apportionment and to brief observations of the results. Thus, the concepts and scope of the estimates in this volume are subject to the same favorable or adverse criticisms as Martin's study.

If one were to group projects relating to quantitative measurements of economic phenomena into two major categories (page Louis Bean!), one including "scientific" statistics and the other including "operating" statistics, the contents of this study would be classified among the latter. It makes no original contribution to either the theory of income or to methods of measurement. On the other hand, the study provides workable and probably fairly accurate estimates of aggregate individuals' income for each state. It is probable that the margin of error in most of the state totals and in their relative positions would be found slight if compared with estimates prepared with greater care and precision. State estimates for some of the specific industrial groups, however, are probably of such questionable accuracy as to render their value doubtful. The author has properly grouped the estimates in broad industrial categories, particularly the weaker series.

The preparation of the estimates was made more difficult by the fact that results of the 1935 Census of Business were, in most cases, not yet available when the study was being prepared. The sources and methods are described in the appendix of the book, but the degree of detail in many instances is not sufficient to permit one to understand the exact sources of data and the precise treatment of the basic material involved in preparing the final estimates. Particularly inadequate were the descriptions of the estimates in those fields where the basic data are least abundant and the methods of estimation are necessarily indirect and involved. This criticism applies especially to the estimates for the government, service, and miscellaneous groups. Generally, it is desirable to be more specific in describing the weaker estimate so as to invite constructive suggestions.

In an effort to show complete estimates of the industrial origin of total "realized production income" for each state, the author had to make the very arbitrary assumption that the breakdown of receipts of dividends, interest, and net rents and royalties by industrial source was the same in each state as for the country as a whole. According to this procedure, if 40 per cent of all dividend payments to individuals in the country originate in the manufacturing industry, then it is assumed that 40 per cent of dividend receipts in each state originate in the manufacturing industry. This industrial breakdown of property incomes in each state added little to the value of the study and in fact unnecessarily weakened the estimates. Certainly, laymen will not comprehend this assumption and its implications, and it would have been much better to limit the industrial breakdown to salaries and wages and to show only state aggregates for the property income items.

In conclusion, the author may be said to have presented in concise and usable form, an up-to-date series of estimates of income receipts in the various states which will no doubt prove useful and helpful to those in need of such data. For marketing and related purposes, the degree of accuracy is probably sufficient to serve the purpose at hand. To one interested in the most scientific and comprehensive estimates of state income possible, the volume leaves much to be desired.

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Long-Term Debts in the United States, by Donald C. Horton. Washington, D. C.: United States Government Printing Office. Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce. Domestic Commerce Series, No. 96. 1937. vi, 211 pp. 20 cents.

Private Long-Term Debt and Interest in the United States, by Leonard Kuvin. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies No. 230. September 1936. xiv, 138 pp. $2.50.

The widespread interest since 1929 in problems of debt naturally has encouraged the growth of literature in the field, and the writings of Snyder, Clark and associates, Edie, Doane, Warren and Pearson, Fisher, and others have received much attention. The statistics of debt have been considerably improved, both through refinements by some of those just named and through closing of gaps in the figures by governmental and other surveys. But the investigator is still faced with important deficiencies in primary debt data—e.g., as to some classes of urban mortgages and as to the ownership of evidences of debt, particularly the holdings of individuals and trustees. A new debt study not concerned wholly with debt theory may devote itself in part, of course, to efforts to supply some of the missing statistics. Or it may also strive, obviously, for better marshalling and collating of available figures, clarification of the boundaries between classes of debt, an all-around betterment in definitions and estimates, or related refinements of concepts or data. It is chiefly, though by no means wholly, in the latter respects that the two studies by the present authors and their respective associates are significant.

Necessarily, the ground covered by the two investigations is alike, in substantial degree, but they do not resemble each other as closely as one might infer from the similarity of titles. Each is concerned primarily with private long-term debt, and each presents detailed estimates of the volume of such debt, by classes, and of the interest charges thereon—for 1912, 1922, 1930, 1934, and scattered figures for other years in Dr. Horton's report for the Department of Commerce, and for 1900 through 1935, yearly, in Mr. Kuvin's study for the National Industrial Conference Board. But, in addition, the former report contains numerous valuable tables on the age-distribution of the various debt classes, estimates on the extent of debt defaults, a detailed appendix of state mortgage-moratoria and related debtor-relief legislation, as well as (primarily for comparison with private debt data, it is stated) substantial chapters presenting the major outlines of public debt data—all topics not emphasized in the present report of the N.I.C.B. The latter study, on the other hand, treats in prominent fashion (approximately one-half of contents) of the economic aspects of debt, particularly of its relationships to income and to the various other economic values supporting the debt and interest structures—problems not within the scope of the Department of Commerce bulletin.

The two analyses yield estimates for the total volume of long-term private debt that are not as unlike as one might have anticipated from the differences in definitions as to what constitutes long-term debts—i.e., those maturing one year or more (with some exceptions) from original date of issue, in Department of Commerce treatment (p. 4), and those maturing five years or more from time of contraction, as viewed by the N.I.C.B. study (p. 2). The first-named study places total private long-term debt at $84.5 billion in 1930 and $73.4 billion in 1935, compared with estimates by the N.I.C.B. for similar dates of $85.8 billion and $76.9 billion, respectively. Estimated extent of decline in totals between the two dates is thus slightly greater for the former than for the latter debt estimates—i.e., 13 per cent versus 10 per cent. Although generalization is difficult, it appears that each study estimates the volume of private long-term debt in the early depression years to have been some 5 per cent to 10 per cent below the estimates of most prior investigators.

Although the two studies agree roughly as to private debt totals, the correlation appears to be partly accidental—differences in one direction for one type of debt happening to be partially or wholly offset by differences in the opposite direction for other items in the composites. These differences are not great except as to urban mortgage debt, which the Department of Commerce bulletin places at $37.2 billion in 1930 and $30.4 billion in 1934, compared with estimates of $43.0 billion and $36.6 billion, respectively, computed for the same years in the N.I.C.B. study. To some degree, these differences in urban debt estimates are explainable by differences in definition—the first-named study regarding as "Industrial" or other debt some data apparently classified by the N.I.C.B. as urban mortgage debt. Seemingly, however, these differences in definition do not account entirely for the discrepancies in the two estimates for urban mortgage debt.

The authors of the N.I.C.B. investigation report that, viewing the period since 1900 as a whole, they find little or no evidence to support the assertion that the increase in the total volume of long-term private debt has been at a rate out of step with the growth of the nation's capacity to support it, as measured by a variable such as national income (p. 4). Questions of this type receive only incidental attention in the other study.

Gratifying features of each volume include extensive notes regarding methods of computation and source materials employed, as well as references to shortcomings in the latter, where known. Also commendable is the practice of presenting explanations for differences in the estimates of various previous investigators, as done for railroad debt in the N.I.C.B. report (p. 28). The authors of the Department of Commerce study have provided estimates of the range of error in their major data—warning signals to the reader unacquainted with the pitfalls in debt statistics. A similar worthy end is served by the practice of the N.I.C.B. report in classifying its major data into "accountable" and "unaccountable" groups, depending on the estimated degree of accuracy. The cautious reader will do well to examine with considerable care the methods employed to arrive at estimates for earlier years, where admittedly the difficulties of providing satisfactory data are considerable. Worthy perhaps of further investigation are the rather peculiar opposite trends during the first dozen years of the present century, shown by the rates of interest on certain classes of debt in the N.I.C.B. calculations (pp. 50, 51).

That all the facts with respect to the trend of interest burdens are not known is a point stressed by the authors of both works. In fact, the authors of the N.I.C.B. study regarded the available data on the trend of urban mortgage interest rates as so uncertain that they merely assumed a flat annual charge of 6½ per cent throughout the period 1900–1935—a method not without its weaknesses, obviously. For multipliers in arriving at the burden of interest charges on urban mortgage debt, the compilers of the Department of Commerce report provided tentative estimates of the rates of interest on such debt for four base years (p. 210). These were assumed to be 6.5 per cent on all urban mortgage debt in 1922, 6.4 per cent for home mortgage debt and 6.2 per cent for other urban mortgages in 1934, with other estimates for 1912 and 1930. These are, of course, not estimated interest rates on new mortgage contracts made but assumed average rates on outstanding indebtedness.

Some question may be raised whether the difference between the rates assumed for 1922 and 1934 may not understate the extent of decline in urban mortgage interest rates between those dates. A study by the present reviewer of the published data for all savings banks in a leading state, and of figures reported publicly by life insurance companies that lend importantly on urban mortgages, revealed rates of interest charged that are well below those cited above—as, of course, is to be anticipated when one considers that the portfolios of these institutions are of first-mortgage character. But more significant in the present connection is the substantially greater extent of decline between 1922 and later dates shown by the average interest rates on outstanding urban mortgage portfolios of these savings banks and insurance companies than by the rates assumed in the Department of Commerce survey for urban mortgage debt generally. It may well be, of course, that trends in these urban first-mortgage interest rates are not truly typical of trends in the rates on the urban mortgage debt structure as a whole; present facts do not provide a final answer to that question.

Minor faults include the omission from a table in the Department of Commerce survey of an explanatory note to the effect that the data in the table are in millions of dollars (p. 2), and an apparent misapprehension in the N.I.C.B. study as to the number of legal-reserve life insurance companies in the United States—the term "legal reserve" being properly applicable to the 318 companies whose data are studied as well as to the smaller sample group of 51 companies (p. 115).

Both volumes obviously represent the results of painstaking and extensive investigation and rank well up among the more important contributions in the field of debt statistics.

CORLISS L. PARRY

New Canaan, Connecticut

Studies in the Theory of International Trade, by Jacob Viner. New York and London: Harper and Brothers. 1937. xv, 650 pp. $4.50.

This book, which consists of a series of studies rather than a treatise on international trade, will prove invaluable reading for the seasoned economist no less than for the novice in this specialized but all-important field. Furthermore, the studies are not confined to international trade alone but branch out into the field of British monetary controversy in the first half of the last century. Indeed, almost a third of the book is devoted to the bullionist and currency controversies as such, while, inevitably, a substantial portion of the remainder of the book is concerned with money and currency as well as international trade. But, as international trade and its operation cannot be discussed intelligently without reference to monetary and currency processes, Professor Viner had perforce to bring in these seemingly extraneous matters—extraneous, that is, to what a narrow interpretation of the title would lead one to expect.

In the first of the studies, attention is devoted to "English theories of foreign trade before Adam Smith." Then follows a discussion of British currency controversies—the bullionist controversy, and the currency school-banking school controversy. The remainder of the book takes up again the thread of international trade analysis. There is given a description of the "theory of the mechanism of adjustment of international balances" (1) "under an international simple specie currency, i.e., with the circulating medium consisting solely of standard metallic money," and (2) "in relation to the modern banking processes." The last chapters of the text, and the most absorbing, discuss the various theories of gains from foreign trade. The first of these two chapters comprises a defense of the comparative-costs doctrine; the second analyzes the concept of the "maximization of real income." The bibliography (30 pages) seemingly leaves little to be desired, and the two indexes—one of names, the other of subjects—are also very well organized and quite comprehensive. While the preface states that the author's excellent article in the *Weltwirtschaftliches Archiv* (1932) was "substantially revised, recast, and extended, in the process of incorporation in this book" (p. xiv), this reviewer would alter the statement to say "was extended, in the process . . . "

The author finds full justification for a separate theory of *international* trade in the international immobilities of labor and natural resources, even in the face of perfect international mobility of capital and imperfect internal occupation mobility of all the factors (p. 598).

The attainment of the author's objective "to resurrect forgotten and overlooked material" (p. xiii) is well illustrated by the following, among many examples. He traces the "concept" of a national balance of trade back to 1381 (p. 6) and "the exact term itself" to 1615 (p. 8). "The term 'favorable balance of trade' . . . so commonly attributed to the mercantilists, seems first to have been used in 1767 by Sir James Steuart, although the phrase 'balance in our favor' had been used by Cary in 1695 . . . " (p. 10). "Invisible items" are not a recent discovery, but reference to them is found as early as 1381 (p. 13). The "infant-industry" argument should not be credited to Alexander Hamilton, but was of earlier origin, appearing in 1645 (p. 71). Even the "economic man" was not a creation of the classical school but a creature of the mercantilists (p. 93). Also, the tabular standard as a basis for contracts, the varying of the weight of coins, and currency convertibility on a fluctuating basis, were some of the currency reform proposals advocated early in the last century. Open-market operations too are not of recent origin (p. 257). Nor was the "non-automatic character of the modern gold standard . . . a discovery of the postwar period" (p. 388). The author also points out that "all the important elements in Adam Smith's free-trade doctrine had been presented prior to the *Wealth of Nations*" (p. 108). But, he claims, they developed from "philosophers, rather than . . . the earlier English economic literature" (p. 109).

The book suffers somewhat from its attempt to be encyclopaedic, to uphold or oppose every word written or even uttered by every recognized economist upon the subject of international trade. Furthermore, dogmatic dicta and caustic comments have no place in what is otherwise so scholarly a work and are diverting, to put it mildly, to the objective, scientific reader. Not every economist can or should subscribe to Professor Viner's theories, nor are all who disagree to be considered of smaller intellectual stature. The reviewer would have been better pleased, too, had the author scattered his hypercritical barbs more widely, giving them a greater dispersion, as it were.

In the opening chapters of the book, treating of mercantilism, it is shown that the mercantilist desire for favorable trade balances rested not only upon increasing the store of precious metals, whatever the purpose—to increase state treasure, to raise prices, to increase trade, to obtain a store of wealth, etc. (Chapt. I, *passim*)—but also upon the hope of increasing employment. Larger exports and smaller imports, especially if the former were largely finished goods, meant greater employment in England (p. 51). The author's analysis of the mercantilists' plaint of "scarcity of money" indicates that it apparently meant all things to all men (p. 88). "The disparagement of consumption and the exaltation of frugality and thrift," in the pre-Adam Smith period, resulted not only from economic reasoning but also from moral, religious, and class precepts (p. 26).

But was it only mercantilist literature which identified the interest of its backers with the national welfare? Was it only mercantilist literature which "consisted of tracts which were partly or wholly, frankly or disguisedly, special pleas for special economic interests" (p. 59)? Rather, has not "disinterested exposition of trade doctrine," as of most economic and other social science doctrine, been conspicuous more often by its absence than by its presence? Further, was it only before Adam Smith that "appeal to political and religious considerations seems often to have been intended to win the support of [certain groups], and seems only rarely to have expressed what was really the primary concern of their authors" (p. 112)? Can we confine to that period the facts that "pleas for special interests, whether open or disguised, constituted the bulk of the mercantilist literature, [and that] the disinterested patriot or philosopher played a minor part in the development of mercantilist doctrine" (p. 115)?

Mercantilist doctrine receded for a time, with the advent of interpretation in terms of a price-specie-flow automatic mechanism. The steps necessary to set up that interpretation in successful "repudiation of certain of the monetary phases of mercantilist doctrine," included acceptance of the quantity theory of money, of sectional prices and their implications, and of the automatic self-adjustment of the international balances (p. 75).

The second portion of the book traces the course of the bullionist controversy in the first quarter or so of the nineteenth century. Professor Viner points out that in the course of that controversy "the germs at least of most of the current monetary theories are to be found" (p. 120).

In various sections of the book it is shown that the growth of central-bank consciousness by the Bank of England was slow and wavering. Central-bank objectives, in general, and the operations necessary to achieve them, under different situations, are presented in a convenient tabulation on page 395.

The statement "that the quantity of bank loans demanded is dependent on the rate of discount is now universally accepted by economists and need not be further argued" (p. 151) is, I think, but partly true, as can be witnessed by events of the recent half-dozen years or so, and it is even modified by the author's listing (p. 238) of other factors influencing the willingness of business men to borrow.

Professor Viner states that the chief contribution of the comparative-costs doctrine was "to correct the previously prevalent error that under free trade all commodities would necessarily tend to be produced in the locations where their real costs of production were lowest" (p. 441). This doctrine, stated as it was in terms of real costs, was not a denial of price influence, but "the real-cost analysis was intended to give significance to the analysis in pecuniary terms, and not to replace it" (p. 483). There was assumed at least a rough proportionality between market prices and real costs (p. 491). Professor Viner's admission, however, that "the course of international trade is governed immediately by prices" (p. 493), comes at a time when other factors than prices are beginning to assume a larger rôle.[1] But the author concludes that, even with the existence of more than one factor of production, the use of factors in varying proportions, and the inability to measure real costs (p. 508), the "doctrine of comparative costs emerges . . . very nearly intact" (p. 500). He seems to dismiss summarily those "economists who *believe* that they have at their command a superior technique than [the comparative-costs doctrine] affords for the appraisal of commercial policy" (p. 438). [Italics mine.]

The contrast between general-value theory and international value theory is noted (p. 583). While the former dealt with money prices and was a partial-equilibrium approach, the latter dealt with exchange ratios between commodities and was a general-equilibrium approach.

Professor Viner's apparent belief in never-changing, underlying fundamentals, coupled with his apparent denial that "what was sound reasoning" at some former time can be "unsound for the present-day world" (p. 111), fails to recognize that different circumstances and different periods of time call for different policies. He himself states, in defending Ricardo's change of heart, that "what would be glaring injustice in the one situation might well be defended as the closest approach to justice available in the other situation" (p. 205). He says also that short-term capital movements may be equilibrating (p. 365), or may operate perversely (p. 407), indicating that their very mobility may at one time be considered an asset and at another a liability.

I wonder whether criticism that a "defense of the theory is essentially empirical rather than analytical" (p. 384) is valid. Should appeal to facts be ignored in economic theorizing?

The *obiter dictum* that "economic analysis can . . . yield only strong presumptions, but this limit in the power of economic analysis extends to the entire field of welfare analysis" (p. 532) is well-taken and very neatly leads to the conclusion that "the theory of international trade, at its best, can provide only presumptions, not demonstrations . . . " (p. 593).

JAMES D. PARIS

Pelham, New York

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[1] *Cf.* C. R. Whittlesey, *International Monetary Issues*, p. 180.

Die Britische Handelspolitik seit Ottawa und ihre weltwirtschaftlichen Auswirkungen, von Dr. Hans Schlie. Jena, Germany: Verlag von Gustav Fischer. Probleme der Weltwirtschaft. Schriften des Instituts für Weltwirtschaft an der Universität Kiel. Herausgegeben von Professor Andreas Predöhl. 1937. xvi, 241 pp. RM 12.-

This treatise on British commercial policy since 1932 is made particularly timely by the recent occurrence of another Imperial Conference on trade policy, as well as by the completion of a number of bilateral trade agreements by the United States. The book furnishes a description and analysis, chiefly statistical, of the development of British policy, the conflict in recent years between British, imperial, and international aims, the policy embarked upon at the Ottawa Conference, and its success up to the present. A rather exhaustive bibliography is included.

Dr. Schlie's theme is that English commercial policy is not to be explained in terms of English conditions alone. Following the confused economic policies characteristic of the postwar period, it became essential in many countries to reconsider both domestic and foreign commercial policies in the light of world conditions. The Ottawa treaty represented for Britain the initiation of a new policy—departure from traditional free trade for a policy of imperial preference designed to enhance imperial unity and prevent the development of an independent economic policy on the part of the Dominions.

The author's conclusion, based of course on only a brief period of operation of the new policy, is that the Ottawa Conference, implemented by the tariff measures which followed, seems to be achieving its purpose of binding the members of the Empire into a closer economic unity, partially, of course, at the expense of some of the countries whose trade with the British Empire formerly assumed large proportions.

MILDRED HARTSOUGH

New York City

World Finances 1935–1937, by Paul Einzig. New York: The Macmillan Company. 1937. xvi, 342 pp. $3.00.

The author of this work is a brilliant and prolific writer on international finance. He has brought to the task of compiling the financial history of our times a keen awareness of the personalities, the politics, and the background of the social and economic developments responsible in large measure for the direction which financial events have taken. He is not, however—and he has made no attempt to conceal the fact—a disinterested and unbiased observer. In this work, just as in his *World Finance 1914–1935*, he has attempted to turn the history of the period into a demonstration of the validity of his own monetary views and of the futility of orthodoxy.

Nevertheless, the work is likely to be useful to the student of recent monetary history, for, while the picture he has painted is colored by his convictions, significant trends and events are carefully and lucidly described. After a brief survey of the financial history of the period 1914–1935, Mr. Einzig has dealt with the events of the period 1935–1937 which offer a sorry picture of currency disintegration, of political and economic contradictions, and of fiscal blunders. The successive crises faced by the members of the gold bloc, the course of reflation, the development of new methods of monetary management, and the probable effects of rearmament on the financial outlook are all dealt with in considerable detail.

Mr. Einzig's interpretation of the facts is likely, however, to be irritating to most readers. He has been bitter and unsparing in his criticism of all that he considers orthodox. He has blamed some of the money managers for mistakes in policy and others for blunders in the method of applying policies which he has, in this as well as in other publications, approved. Furthermore, the method of treatment he has followed is far removed from that calm appraisal of events which is essential if the history of the period is to yield something of real value for the future. Fundamental to Mr. Einzig's point of view is the conviction that in most countries debts are so high that there is no alternative but to devalue currencies to a point where the advance in prices will reduce the burden of servicing them. He appears to see much more clearly than do most observers that fiscal heterodoxy is, over a long period of time, mutually inconsistent with monetary orthodoxy. He fails to give adequate weight, however, to the fact that monetary devaluation is a palliative and not a cure and that repeated doses of the inflation medicine cannot be taken without causing difficulties even more serious than those which would be alleviated.

He seems, moreover, to miss the most important point of all, namely, that many of the recent mistakes made by the monetary authorities have been the outgrowth of their frantic efforts to repair the damage caused by previous errors of policy and judgment. The moral should not have been that nations must devalue and inflate whenever political expediency has encouraged them to build up an unwieldy debt burden but rather that debts must not be expanded to a point where governments will be forced to repudiate them through inflation.

MURRAY SHIELDS

Irving Trust Company

A Program of Financial Research, National Bureau of Economic Research, in co-operation with Association of Reserve City Bankers.

Volume One: *Report of the Exploratory Committee on Financial Research of the National Bureau of Economic Research.* New York. 1937. Studies in Finance, Number One. x, 81 pp. $1.00.

Volume Two: *Inventory of Current Research on Financial Problems.* New York. 1937. Studies in Finance, Number One. viii, 253 pp. $1.50.

These two small volumes outline perhaps the most ambitious project for co-ordinating government, foundation, and private research in the field of financial economics that has yet been proposed.

Under this plan, the National Bureau of Economic Research is to seek the co-operation of Government, business, educational, and other interested agencies in sponsoring a permanent central staff. This staff is to inaugurate a comprehensive survey of the nation's financial structure, formulate specific research projects to study problems neglected by present investigators, launch commissions of inquiry on major questions of policy, and assure the publication of the results of this program so that they will be generally available.

Funds are to be raised from non-governmental sources to finance the central agency and the specific research projects inaugurated by it. The National Bureau of Economic Research has enjoyed the co-operation of the Association of Reserve City Bankers in working out this program.

The first of these two volumes contains recommendations for research co-ordination from the Exploratory Committee, consisting of Winfield W. Riefler, Walter Lichtenstein, David Friday, and J. H. Riddle. It contains also brief summaries of a number of suggested research projects, such as "Changes in the Capital Requirements of Business Enterprises," "Major Factors in the Fluctuations of Bank Deposits during the Past Decade," etc.

The second volume presents a summary of the work that is now going on in Government agencies, in commercial organizations, in research bodies, and by individuals in the field of finance. It is a helpful and impressive, if incomplete, survey of current research.

There can be little question that financial research at the present time suffers from a notable absence of co-ordination. This brings not only a large amount of duplication of effort but also the neglect of a number of problems. Hence, the establishment of a single central agency to co-ordinate and foster such research would be a commendable experiment.

As has been demonstrated by other attempts to co-ordinate any large field of intellectual activity where principles and methods are far from standardized, however, the results will largely depend upon the quality of the leadership that is offered. In the field of financial research particularly, sterile compilations of statistical data that prove the merely obvious have been presented all too frequently as original studies of complex problems. Co-ordination of research must at times be concerned as much with the discouragement of such arid and useless projects as with stimulating constructive and significant contributions to our understanding of financial institutions and trends. Some of the sample projects outlined by the Committee in the first of these two volumes clearly involve the risk of evoking merely more pretentious statistical restatements of well-known developments and tendencies, without adding to our knowledge of their nature and significance.

JULES I. BOGEN

The Journal of Commerce, New York
and New York University

Wholesaling, Principles and Practice, by Theodore N. Beckman and Nathanael H. Engle. New York: The Ronald Press Company. xvii, 628 pp. 1937. $4.00.

Although not a new edition or revision of *Wholesaling*, written by Professor Beckman and published in 1926, the present volume is so clearly a lineal descendant of the earlier book that comparison is inevitably invited. This procedure is particularly appropriate since the contrast between the two volumes reflects faithfully the increase in the general fund of knowledge about wholesaling and marketing during the decade between the two publication dates.

It is perhaps needless to state that, useful as the earlier volume is, the second represents a substantial advance: the continued researches of Professor Beckman, the addition of Mr. Engle, with his extensive background in the field, as coauthor, and the new data made available by the Census of Business are sufficient guarantees of that.

Whereas Professor Beckman's earlier book devoted 524 pages of a total of 596 to the internal problems of operation of wholesale enterprises, such as organization, brand policies, purchasing procedures, and warehouse operation, these topics have been compressed to 123 pages of a total of 600 in the new book. Since much of the material in the first volume is still pertinent, the two books may profitably be considered as complementary. The space released by this compression in Beckman and Engle has been utilized for a careful definition of wholesaling; a brief history of the development of wholesaling; a detailed survey of the present wholesaling structure in the United States, based largely on census data; an appraisal of the overall efficiency of wholesaling institutions; a summary statement of basic problems in the field; and an examination of the relations between government and wholesaling.

Rejecting all suggestions for more elaborate classification, the authors divide marketing into two categories, wholesaling and retailing, with the following definition of the former: "Wholesaling includes all marketing transactions in which the purchaser is actuated solely by a profit or business motive in making the purchase." Having taken their stand in favor of this delimitation of the boundaries of wholesaling, the authors point out the narrow view which associates wholesaling solely with the activities of wholesalers selling to retailers and the compromise made by the Census Bureau in including the marketing activities of manufacturers' sales branches but not of central offices.

The definition and classification adopted has much to recommend it. It is simple, and the criterion of the purchasers' objective is clear-cut for the most part, although there are some twilight zones. But there are disadvantages in bringing within the boundaries the marketing activities of farmers, prime producers, manufacturers, assemblers of waste products, mill supply houses, without subsequent subclassification which emphasizes the essential difference in function and method of operation between the *assembler* of raw materials at one end of the marketing chain and the *distributor* of finished products at the other. Again, although it is true that the manufacturer who distributes his products direct to retailers performs wholesale functions, it would seem that his objectives and methods differed sufficiently from those of wholesalers assembling products from many sources for distribution to retailers to cast some doubt on the desirability of including both in the same category. A curious confirmation of the validity of the question lies in the fact that, in spite of the title of the volume and the definition adopted, the authors devote very little attention to the marketing activities of manufacturers, and that little appears in a chapter entitled "Circumventing the Wholesaler."

The analysis of the data made available by the Census Bureau, with which work both authors were associated, is a particularly useful section. The chapter on the efficiency of wholesale institutions raises some questions which need not be detailed here but represents a suggestive approach.

In summary, the volume is one with which everyone interested in marketing should be familiar.

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Big Business: Its Growth and Its Place. New York: Prepared under the Auspices of the Corporation Survey Committee of the Twentieth Century Fund, Inc. 1937. xv, 102 pp. $1.35.

Because of the great importance of the large corporation in our modern economy, each new effort to measure the growth and extent of corporate concentration must be welcomed and carefully appraised. The first result of the recent survey of "Big Business" conducted by Dr. Rufus Tucker for the Twentieth Century Fund has appeared under the title *Big Business: Its Growth and Its Place.* This small volume purports to cover the growth and extent of incorporation, the rise of large corporations, and the degree of corporate concentration according to various measures. But since the discussion of the rise of large corporations is devoted almost solely to summarizing the results of two well-known studies of industrial mergers, the volume must be judged by the evidence presented as to the present position of large corporations.

As a first step in arriving at the role of large corporations, the report presents figures which purport to represent the percentage of the 1929 national income produced by corporations in each major branch of the economy and for the economy as a whole. According to these figures, 57 per cent of the national income of that year was produced by corporations (page 17). No indication is given as to how these figures were arrived at. A footnote explains that "sufficient space is not available to explain the methods used to arrive at the estimates of the percentage of income produced by corporations." For three branches of activity the estimates appear to be rounded thirds. As these estimates are used as a base in establishing the role of large corporations, the lack of supporting evidence is unfortunate.

In the second step depicting the role of large corporations, the relative position of the large corporations with respect to all corporations is measured by assets and by income. In the measuring by assets, any corporation with assets over 50 million dollars is classed as large, and, using the raw "Statistics of Income" figures, the conclusion is reached that, in 1933, 594 large corporations owned 53.2 per cent of all corporate assets and that, if only nonfinancial corporations are considered, 375 corporations owned 56.2 per cent of total corporate assets (page 54). Similar crude figures show that, excluding investments in other corporations, 49.9 per cent of corporate assets are owned by large corporations and 55.0 per cent of capital assets (land, buildings, and equipment) belong to the big companies (page 65).

In spite of the large degree of concentration of corporate wealth shown in this picture, it appears to minimize the true degree of concentration. The crude figures supplied by the Bureau of Internal Revenue in its "Statistics of Income" do not consolidate subsidiary companies except when the parent company owns at least 95 per cent of the voting stock and not always then.

An unpublished sampling study made by the present writer indicates that for nonfinancial corporations the assets shown in fully consolidated statements are appreciably greater than the assets shown in the partially consolidated statements filed by the same big companies in their income tax returns. The "investments" of the big companies represented in part voting control over other companies. For every dollar of "investments other than tax exempts" the sample group of companies controlled appreciably more than a dollar of assets other than investments. A rough indication of the magnitude of the underestimates resulting from the use of partially consolidated returns can be obtained by making the very conservative assumption that every dollar of investment other than tax exempts represents only 50 cents worth of assets other than investments and that securities held by financial companies are pure investments. In the table below a comparison is made between the results obtained by the Twentieth Century Fund using partially consolidated returns and the results obtained by completing the consolidation on the basis of the conservative assumptions given above. Since the basis used here for completing the consolidation is crude, the results cannot be regarded as at all accurate. They probably tend, however, to minimize the degree of concentration as the basic assets represented by a dollar of investments are more likely to be in the vicinity of a dollar rather than 50 cents. Certainly these figures suggest the extent to which the Twentieth Century Fund report minimizes the degree of corporate concentration.

In the text of the Fund report, this understatement due to the use of partially consolidated statements is mentioned in passing (page 56), but no effort is made to adjust for this inadequacy, and the figures obtained are interpreted as if there were no significant underestimate. This was done in spite of the clear warnings in earlier writings on the subject which were available to the Fund.

	Proportion of Assets Held by Corporations with 50 Million Assets or More	
	Calculated by 20th Century Fund on basis of partially consolidated statements	Estimated conservatively on basis of crude adjustment to approximate complete consolidation[1]
For all corporations		
Total assets	53.2	56.8
Total assets less investments other than tax-exempt	49.9	54.3
Capital assets (land, buildings, and equipment, less depreciation)	55.1	61.6
For nonfinancial corporations		
Total assets	56.2	60.6

[1] According to information obtained from the Bureau of Internal Revenue, the investments other than tax exempts reported in 1933 by nonfinancial corporations with assets over 50 million dollars amounted to 17,747 million dollars. The adjustment for partial consolidation was made by assuming that through the ownership of these securities the large corporations controlled 8,874 million dollars worth of assets other than securities. It was also assumed that this 8,874 million dollars of assets was controlled by the ownership of 4,437 million dollars worth of securities.

In estimating the degree of corporate concentration on the basis of income, the same failure to make any adjustment for partial consolidation exists. In this case no mention at all is made of the underestimate resulting, and the estimates arrived at are treated as if no underestimate existed. Thus the estimates of the role of the large corporations, in relation to all corporations based on assets and income greatly underestimate their true significance.

The third step in picturing the role of the large corporations is taken by estimating the proportion of the total national income produced by the large corporations in the major branches of industry and for the national economy as a whole. This is done by apportioning the figures of national income produced by corporations between large and smaller corporations. The basis used for making this apportionment is neither assets nor income but the "compiled receipts" reported to the Treasury in income tax returns and roughly representing the volume of sales for each enterprise reporting. This procedure compounds the underestimate due to the use of partially consolidated statements with a second underestimate of perhaps even greater importance. "Compiled receipts" represent the total receipts of an enterprise, not its contribution to national income. It can only be a good basis for apportioning national income produced between large and small enterprises if the small companies on the average contribute about the same amount to national income per dollar of sales as is contributed by the large companies. Since the large companies tend to be more integrated than the small, a given dollar of sales is likely to cover more stages in the industrial process than in the case of a small company. Thus when a Ford produces coal, uses it to make coke, then steel, then automobiles, the "compiled receipts" of the company include only the money received from the sale of the car. If each activity were carried on by a separate enterprise there would be a recording of "compiled receipts" between each enterprise, one for coal, another for coke, another for steel, and finally the same figure of receipt for the completed car as in the case of the integrated company. Thus for contributing equally to the national income, the integrated company would report a much smaller figure of "compiled receipts" than the sum of the "compiled receipts" of the unintegrated companies doing the same job. The integrated company will contribute more to the national income per dollar of sales than each unintegrated company. Since the large corporations are integrated to a greater extent than smaller corporations, the use of "compiled receipts" as a basis for apportioning national income produced tends to minimize the national income produced by the large corporations.

Using "compiled receipts" as a basis of apportionment, the report presents figures indicating that only 32.3 per cent of the national income produced by corporations is produced by large corporations.[2] This is a surprisingly small proportion in the light of the Twentieth Century Fund's own figures which indicate that 53.2 per cent of the assets of all corporations are owned by the large companies. Although the proportion of all corporate assets which are owned by the large companies is undoubtedly greater than the proportion of the corporate contribution to national income, such a great difference as that between 53.2 per cent and 32.3 per cent seems unlikely. Much of the discrepancy is undoubtedly due to the faulty character of "compiled receipts" as an index of "national income produced." Both figures would, of course, be revised upward by complete consolidation of legally controlled subsidiaries.

Once this questionable figure of 32.3 per cent is arrived at, it is used to apportion the national income produced by corporations (the unsupported figure of 57 per cent) between the large and smaller corporations. The resulting figure of 18.4 per cent representing the proportion of the national income produced by large corporations is unquestionably an underestimate. If the apportionment between large and smaller corporations were made on the basis of consolidated assets, the resulting figure for the contribution of large corporations to the national income would be approximately 32 per cent. The true figure is likely to lie midway between these two extremes, say at least 25 per cent.[3] Crude though this figure is, it does indicate the magnitude of the underestimate involved.

The fact that all the errors pointed out above lead to underestimates of the role of "big business" should not be lost to sight. Throughout this Twentieth Century Fund report there appears to be a consistent tendency to minimize the importance of the large corporations and to maximize the importance of small enterprise. This finds expression in the concluding section which says, after stating that only 18.4 per cent of the national income was produced by large corporations, "from this point of view the large corporation sinks into relative insignificance" (page 99). This tendency is reflected in the frequent treatment of government activity as if it were carried on by small enterprises. Thus, one of the main conclusions of the book reads, " . . . taking the broadest view, it can be truthfully said that 81 per cent of all American economic activity is carried on by medium or small corporations, by firms which are not incorporated at all, or by individuals" (page 98). To get this statement from the figures of the report, government must be classed as a medium or small corporation, as an unincorporated firm or else as an individual. Again it is stated that "more than two-fifths of the entire business activity in the United States is not in corporate hands at all —much less in the grip of the giants" (page 98). Here government is classed as "business" (as is also the activity of domestic servants) and is included as part of the business activity not in the hands of giants—there are few corporations that employ more people than the city of New York and none that employ more than the Federal Government.

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[2] The figure of 32.3 per cent is not presented in the report directly but only by implication.

[3] This figure would imply that 44 per cent of the national income produced by corporations was produced by the large companies if 57 per cent of all national income was produced by corporations.

Throughout the book as a whole this verbal bias has been mostly removed. The statistical bias, however, remains. Only the more glaring cases have been pointed to in this review, these errors make both the total figures of concentration and the industry-by-industry figures unreliable. No mention has been made of numerous minor errors, yet without exception they all tend to minimize the degree of corporate concentration.

The only significant contribution which this book makes beyond its title is the publication of an excellent chart (page 42) prepared by the Bureau of the Census at the request of the Twentieth Century Fund. This chart shows the proportion of wage earners employed by the largest companies in each of 84 industries and is in great contrast to the statistical weakness of the report.

GARDINER C. MEANS

Washington, D. C.

How Profitable is Big Business? New York: Twentieth Century Fund, Inc. Prepared under the direction of the Corporation Survey Committee of the Twentieth Century Fund, Inc. 1937. xviii, 201 pp. $2.00.

With the publication of *How Profitable is Big Business?* a worth-while addition is made to the now fairly sizable collection of monographs devoted to a study of corporate profits. In the foreword the reader is informed that the authors have attempted to answer certain questions about the relation between size and profits, size and income and outgo, size and turnover of capital, size and dividends. The statement is made also that only factual conclusions drawn from statistical material presented have been set forth. In short, the reader is warned not to look for economic judgments or suggestions for action.

In form and style the book is admirably done for the reader who turns to the book solely to glean the factual information promised. The sources and limitations of the data presented, and the accounting concepts used, are adequately discussed. The actual study is divided into two sections (the book is presented in four parts) differentiated chiefly by the source of the data used.

In Part II profits of large versus small corporations are studied by utilizing *Statistics of Income.*[1] These data unfortunately cover only the three years 1931, 1932, 1933, but of course include records of hundreds of thousands of corporations and are broken down into size and industry classifications. Furthermore, the accounting concepts used, net income on net worth, total profits on total capitalization, etc., are applied separately to all corporations, to profitable and to nonprofitable corporations. Part II also includes a brief consideration of banking profits based upon data compiled by the Federal Reserve Committee on Branch, Group and Chain Banking.

In Part III data extending over the period 1900–1935 are presented for several groups of large corporations. Different groups of corporations were studied for selected intervals within this span of years; the data used were compiled from financial manuals. In this section emphasis is given to the fate of mythical investors in various assortments of shares of the corporations studied. In view of the difficulties and limitations involved in such procedure, undoubtedly recognized by the authors, the reviewer believes that Part III might have been omitted without impairing the value of the monograph.

Of interest to the student of corporate profits is that portion of the appendix material which adjusts the ratios net income to net worth and total profit to total capitalization by smoothing out differences in the percentage of gross income allotted to officers' compensation and to depreciation and depletion accounts. In general, for profitable corporations the adjusted ratios exhibit the same trends and differences by size groups as the unadjusted ratios presented in the text. For unprofitable and for all corporations interesting deviations arise. These, for the most part, are not explained by the authors. Despite the foreword warning that the study would be purely factual, the reviewer must confess to disappointment not only in the brevity of the chapter titled "Conclusions," but in the paucity of analytical treatment throughout the book. Among the conclusions reached are the following:

1. There are characteristic differences among classes of corporations of various size.
2. On the whole the largest corporations were the most profitable if profit on gross income is used as the criterion of profitable.
3. Among money-making corporations the smallest corporations were the most profitable if profitableness is measured by relating net income to net worth, or total profit to total capitalization.
4. There is an inverse relationship between size (of assets) and turnover (of assets).

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[1] United States Treasury Department, Bureau of Internal Revenue.

5. The percentage of net income paid in dividends increases with increasing corporate size.

6. Larger corporations have "sounder financial set-ups" and are "safer."

The first four of the above conclusions were published in June, 1934, by W. L. Crum in his analysis of *Statistics of Income* for the year 1931.[2] The remaining conclusions cited above are perplexing. Over a period of years, of two corporations, the one which plows back the larger percentage of earnings, other things being equal, will show a relatively greater increase in the ratio of surplus to total capitalization. Hence if the dividend-net income ratios for large and small corporations were to continue the relationship shown for the years 1931, 1932, 1933 one would expect that the "financial setups" of the larger corporations would deteriorate relatively to the smaller corporations. (Granted that the percentage of surplus to total capitalization is a criterion of "soundness.") The authors justify their conclusion that large corporations are "safer" on two grounds:

(1) the larger corporations have "a smaller proportion of borrowed capital in their financial structure;"

(2) "compared with the smaller ones, a larger proportion of their borrowed capital has fixed maturity dates."

The data presented (Table 15, page 60) show that for corporations showing net income the smallest size class borrowed 29.9 per cent of total capitalization; the largest size class 29 per cent. The size class which showed the smallest proportion of debt, 20.2 per cent, was third from the largest of the nine classifications given. To the reviewer the slightness of the disparity between large and small corporations with respect to the proportion of borrowed capital is more striking than the statistical fact that "large corporations have a smaller proportion of borrowed capital."

The authors' statement to the effect that fixed debt is less onerous than floating debt is interesting but is, of course, offered without statistical verification and hence departs from the factual conclusions to which they were committed. In fact they present data (Table 15) showing that in each size group for profitable corporations the floating debt is a larger proportion of total debt than in the case of unprofitable corporations.

These comments on the authors' conclusions are not intended to belittle the value of their research. The book raises many questions not expressed by the authors and will tempt the reader to develop his own interpretations and analyses. It must be emphasized that the authors were not committed to analytical treatment. Furthermore, the book is a summary of certain chapters of a forthcoming study in which economic judgments and suggestions for action will be formulated. Perusal of *How Profitable is Big Business?* leaves one eager to examine the final results of this valuable research project.

SAMUEL S. STRATTON

Graduate School of Business Administration
Harvard University

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[2] *The Effect of Size on Corporate Earnings and Condition*, William Leonard Crum, Business Research Studies, No. 8, Harvard University, Graduate School of Business Administration.

NRA Economic Planning, by Charles Fredrick Roos. Bloomington, Indiana: The Principia Press, Inc. Cowles Commission for Research in Economics, Monograph No. 2. xxii, 596 pp. $5.00.

Much of this book is based upon the author's experience as former Director of Research of the National Recovery Administration and consists of a rather personalized account of the formulation of the policies and the administration of the NRA. Few features of the measure are approved, and the program as a whole is described as "the monstrosity that during 1934 and 1935 had kept business in a churn, prevented reemployment, and consequently retarded American development."

In developing his thesis the author traces the growth of the idea of the NRA and discusses the difficulties encountered in recruiting a competent staff and in attempting to regulate hours of labor, wages, collective bargaining, and prices. Only a suggestion of the detailed treatment accorded these various topics can be presented here.

Decreasing hours of labor simultaneously in all industries probably slowed down improvement in the standard of living. Minimum wages resulted in an abnormally large number of workers receiving near the minimum, and multi-minima wage rates were responsible for some migration of industry and population to lower-wage regions. But since there were many increases in wage rates above the minimum, there was probably no reduction in the average wages for all industries.

The labor union movement was in the doldrums on the eve of the NRA because of labor's inability to establish a constructive program. Although Section 7 (a) did not supply a program it did provide an effective stimulus to the unionization movement and possibly led labor leaders to overreach themselves. They are criticized for not knowing when to stop in their demands and are admonished to study modern economic theory.

The problem of regulating prices under the NRA is approached through a consideration of cost. After a discussion of the difficulty of arriving at a workable concept of cost, the phenomenon is summarized as "an arbitrary or fictitious quantity which enables a business man to conduct his affairs with some degree of intelligence." That such an amorphous concept was an unsatisfactory basis for price regulation is amply attested.

The open price policy which was included in many of the codes is appraised as being the most important reform attempted under the NRA, although, as the author points out, the open price policy made for coercion and monopolistic control and was frequently ruinous to small business.

Economic planning under the NRA was "little more than the swapping of bargaining positions—monopolistic advantages for labor concessions—with the choicest gains going to the groups exhibiting the greatest political power . . . . And since such planning prevailed under the NRA, we must commend the Supreme Court for invalidating the Act. Recovery in substantial measure could not set in until this was done."

Assembling and analyzing statistical data is regarded by the author as constituting the most important problem of direct-control economic planning. He asserts that "as long as such large gaps in statistical information exist economic planning, even of a mild 'fixing' type must remain impracticable." In making this assertion he ignores the obvious fact that in our society statistics may be piled on statistics like Ossa on Pelion unto the seventh heaven without protecting the choicest gains from going to the groups exhibiting the greatest political power. Moreover, it might reasonably be argued that this fact does not constitute a forbidding barrier to fundamental social and economic reform.

In general the study is dominated by the traditions of classical economic theory, which lead the author to the conclusion that many of the NRA's troubles were traceable to "its failure to establish broad policies resting on long-established principles based upon common sense." Thus one gets the impression that the choice ultimately rests between a planned society and the *status quo ante*. Such an approach, which avoids the necessity of critically analyzing the forces that in the past have determined rights and privileges, places at a disadvantage any measures which threaten to modify social arrangements. Had the author given more attention to the critical social and economic conditions which existed during the months immediately preceding the inauguration of the NRA he might have had more difficulty in developing his *ex post facto* arguments to support the Supreme Court in its unanimous adverse decision.

COLLIS STOCKING

Washington, D. C.

Controlling Retailers, A Study of Co-operation and Control in the Retail Trade with Special Reference to the N.R.A., by Ruth Prince Mack. New York: Columbia University Press. London: P. S. King & Son, Ltd. 1936. Studies in History, Economics and Public Law, No. 423. Edited by the Faculty of Political Science of Columbia University. 551 pp. $4.50.

In the words of the late Allyn Young, if human behavior turns out to be something radically different from what is generally assumed in economic theory, the extent to which economics must still be rewritten is little understood. The thought that the basic assumptions as to human motives and reactions upon which the structure of economic theory has been erected may not have been wholly adequate for the relatively static conditions of the period in which they were formulated, and are certainly inadequate for a period the outstanding characteristic of which is rapid change, has been disturbing an increasing number of students in recent years. This disturbance has led to an intensified study of human behavior from many angles, accompanied by a general desire to adapt and use, so far as possible, laboratory techniques.

One such study is reported on in *Controlling Retailers*, by Mrs. Ruth

Prince Mack. Mrs. Mack's objective in studying the development, administration, and results of the N.R.A. General Retail Code was "to view the actual behavior of business men in order to learn what assumptions could properly be made concerning their economic nature and, conversely, to see the full implications of these assumptions when reflected in a pattern of action." As sources for her material, Mrs. Mack combined employment on the staff of the New York Retail Code Authority with what was obviously a tremendous amount of individual investigation. The result is a substantial volume, carefully documented and closely reasoned. The conclusion with respect to the specific N.R.A. experiment that "the operation of the Retail Code, in the setting in which it was placed, did not substantially further the public interest" is not startling and coincides with the judgment of many observers working perhaps with less detailed materials. The conclusion on the broader question embodied in Mrs. Mack's stated objective will not prove satisfying to seekers of the novel and revolutionary. She writes: "Behavior in relation to N.R.A. was typically predicated on self-interest; it was based on a judgment as to the direction of business advantage. Moreover the conception of self-interest was narrow; it was not extended in either the time or space dimension—business men were more concerned with advantage in two months than in two or ten years; there was little extension of the idea of 'self' to include other members of the trade and none to include all business men." This conclusion leads Mrs. Mack to a scrutiny of the types of pressures which may be brought to bear in lieu of voluntary co-operation, which scrutiny in turn ends with the final conclusion that "legislation of the N.R.A. variety deals largely with a category of economic phenomena which either cannot be controlled at all or controlled only at an excessive price."

Obviously many proponents of control will challenge Mrs. Mack's concept of what constitutes an excessive price. Moreover, the brief period during which the N.R.A. was in operation may be advanced in extenuation of its shortcomings. Nevertheless, Mrs. Mack has marshalled an imposing, and to this reviewer a convincing, array of evidence in support of her position.

Mrs. Mack makes her way to her conclusions through four sections devoted respectively to "Pre-Code Co-operation and Controls," "The Genesis of the Code," "Code Administration," and "The Retail Trade Under the N.R.A." The first adds little to the available material but undoubtedly is a necessary prelude to what follows. The sections on the "Genesis of the Code and Code Administration" reveal care and persistency in unraveling a tangle of motives and events and provide a convenient summary. To most readers the section on "Retail Trade Under the N.R.A." should prove of most interest. This survey of the effects of labor and "fair trade" clauses on all parties at interest, employes, stores, resources, and customers, is the direct basis for the conclusions already cited.

This book is definitely not one for the casual reader. Nor do all parts equally repay close attention by the interested student. Nevertheless, Mrs. Mack has clearly made a definite contribution to the growing literature on social control of economic activity.

STANLEY F. TEELE

Harvard University

Sugar, A Case Study of Government Control, by John E. Dalton. New York: The Macmillan Company. 1937. x, 311 pp. $3.00.

The rapid expansion of Federal control of economic activities under the Roosevelt Administration has given rise to loose and acrimonious debate concerning the role of the State in economic life:

> The point of view held throughout this book is that discussion of the merits or demerits of the enlargement of Federal power in such general, vague, and elusive terms as "private initiative," "control of economic forces," "interference with property rights," or "planned or planless economy," is not conducive to a sane and effective analysis of a difficult problem . . . what is sorely needed is a specific inquiry into a long list of cases where government and business have come into contact. . . . The primary purpose of this study is to ascertain the past and present relationship of economics to politics in a major food industry, sugar, in order that these findings may be checked against the convictions commonly held by business men in the larger realm of business and government. . . . Emphasis is placed upon the existence of a national problem requiring a national political solution, rather than upon the wisdom of any particular solution. This is done with the conviction that the most effective method of studying the necessarily complicated problem of government and business is to examine, by the case method, the facts as they have been disclosed (pp. 6–9).

Following this statement of scope and method are seventeen brief chapters reviewing and analyzing the relations which have existed between the Federal Government and the sugar industry (this term includes the sugar industries of continental United States, the insular areas, and Cuba) from 1789 to 1936. After a general description of the sugar industry in recent years, Dr. Dalton traces the evolution of government policy toward sugar through the Great War; then turns to a consideration of the world depression in sugar which set in after 1925, its impact upon the areas supplying the United States, and the unsuccessful attempt to offset the decline in the price of sugar by raising duties in the Smoot-Hawley Tariff of 1930.

Not only did this action fail to lift the domestic price of sugar but operated to reduce imports into the United States from Cuba, thereby aggravating the economic distress which had already gripped the island. A new solution was sought in a quota system which allocated the annual consumption of sugar in the United States among the several producing areas and involved a large reduction in the duties on Cuban sugar. The quotas were established under the Jones-Costigan amendment (1934) to the Agricultural

Adjustment Act of 1933, and the Cuban duties were reduced, first under the flexible tariff provisions of the Tariff Act of 1930, and later under the Trade Agreements Act of 1934.

In dealing with the quota system, Dr. Dalton describes the abortive stabilization agreement which the sugar industry formulated under the marketing agreement sections of the Agricultural Adjustment Act, the government's plan as embodied in the Jones-Costigan Act, the establishment and administration of the marketing quotas, and the synchronization of production with marketing quotas by means of production adjustment contracts. After this general account, the individual producing areas are treated separately. Each of these analyses includes an historical sketch of the development of sugar production, an appraisal of the effects of tariff policy and the quota system, and an outline of future problems. Lastly come chapters devoted to the domestic refining industry, the consumer interest, and a reconsideration of the general problem of the relation of government to business.

As an historical account of the development of the sugar industry under tariff protection and as an analysis of the background and operation of the Jones-Costigan quota system, Dr. Dalton's volume is excellent. It is lucidly written: a noteworthy accomplishment in view of the complexity of the subject and the fact that a very considerable amount of statistical material is incorporated into the text. The author's close contact with the sugar problem as Chief of the Sugar Section in 1934 and 1935 imparts a flavor of realism frequently absent in economic writing.

In the final chapter, Dr. Dalton links the case of sugar to the wider problem of government and business which was touched upon in the opening chapter. Although admitting that sugar is a special case, he contends that it throws light upon the general problem. The conclusions are: that the roles of government and business cannot be rigidly separated; that government policies may be as important as the forces of free enterprise in the development of an industry; that Federal control once given is difficult to withdraw; that although some industries possess leadership sufficiently strong to carry out general programs, many require government supervision; "that the revolt against government regulation comes primarily when that regulation diminishes the prospects of profit, not when it improves them" (p. 306); that the extent to which government rationalization of industry is feasible varies from industry to industry; that business cannot call for more government assistance on the one hand and demand a reduction of the Federal bureaucracy on the other; that the complaint that business is being constantly upset by legislative surprises is largely unwarranted, since most legislation has its roots in the demands of business itself; and that, contrary to common statement, the government is quite capable of assembling a competent personnel to administer public policies. Dr. Dalton concludes that:

> What is imperative is not so much the creation of a trained administrative staff, but the setting up of appropriate government machinery in the Federal sphere to evaluate the claims for assistance that are constantly advanced by agricultural, business, and labor groups (p. 309).

It is with respect to these general aspects of the relation of government to business that certain questions arise in the mind of the reviewer. Although agreeing that "careless declamation" is of no help in solving the general problem of government and private enterprise, the reviewer believes that Dr. Dalton, in his preoccupation with the case approach, has underestimated the extent to which general economic reasoning is helpful in working toward a solution. The penetrating essays of Professor Pigou, issued under the title of "Economics in Practice" come to mind as an example of what may be accomplished along this line. Throughout his treatment, Dr. Dalton appears to consider the relations of the government to business in terms of conferring assistance on, or withholding it from, claimant groups. Although this is one phase of the matter, it hardly covers the entire field. Legislation aiming at the settlement of labor disputes, the enforcement of fair trade practices, the stimulation of reciprocal trade, and the conservation of natural resources are in rather a different category from measures designed to increase the profitability of individual industries. Thinking upon policies such as these must needs run in terms other than those of giving or withholding assistance.

Although Dr. Dalton's conclusions are interesting and valuable, it is disappointing not to find an analysis of the general problem of subsidies and the implications of quota control. The reviewer is aware that Dr. Dalton explicitly stated (p. 6) that he did not intend to evaluate the sugar program as such and is not complaining of the absence of a critical evaluation of the Jones-Costigan program or that Dr. Dalton did not present his own suggestions on a long-run program for sugar. The situation in sugar, however, clearly raises the whole problem of the desirability and standards of subsidizing domestic industries and also that of the conflict of interest between protected domestic producers and the producers of export commodities. Furthermore, the technique of quota control carries implications that are certainly germane to the problem of government and business. The traditional protective tariff, although distorting the economic structure, does not prevent the functioning of the international price mechanism. But quotas, as Professor Haberler has pointed out, are alien to the price system. They break down the interaction between domestic and international prices and prevent adjustments in production which would otherwise have taken place. It seems to the reviewer that some generalizations with respect to these problems might well have found a place in the final chapter.

J. P. Cavin

Washington, D. C.

Marketing Research—Its Function, Scope, and Method, by D. M. Phelps. Michigan: Bureau of Business Research, University of Michigan. Michigan Business Studies, Volume VIII, Number 2. 1937. iv, 149 pp. $1.00.

In this monograph Professor Phelps has dealt with the philosophy rather than the technique of marketing research. From reading it the average teacher of marketing or director of marketing research will probably derive no new fact concerning this type of activity nor will he learn any new method used in carrying it on. When he lays the book down, however, he should feel, if he has read it carefully, that his ideas concerning the subject have undergone a process of orientation and that, as a result of its perusal, he is possessed of a much clearer concept of the relation of marketing research to the several phases of human thought and activity upon which it impinges.

The first of the three parts of the study deals with the place of marketing research in economic theory. The discussion of this phase of the subject centers around the use of this activity as a means by which the market may be intelligently anticipated in the course of the so-called "round-about" method of production. Through its use the enterpriser who must manufacture in anticipation of demand can suit both the characteristics of the article he produces and the amount of it he makes more precisely to the future requirements of the market than was possible under the old system of glorified guesswork. It thus makes it possible for such movements as the mechanization of industry, large-scale production, and division of labor to be carried to lengths to which they could otherwise not be developed without a dangerous enhancement of the risks of business enterprise.

The second section of the study relates marketing research to the work of the executive who is charged with managing the distribution activities of a business. This involves an analysis of the task of this official which is found to consist mainly of the manipulation of demand and the control of marketing efforts and expenditures. The section includes numerous examples of studies which have been useful in this managerial work.

In a third section the question of the extent to which marketing research is scientific in its attitude and technique is discussed. It is pointed out that those engaged in this work make rather more use of the inductive than they do of the deductive approach. In its use of the inductive method, also, marketing research relies much more on observation than upon experimentation in the collection of facts for analysis; for the material with which it deals is of such a character that usually none of the causal elements involved therein can be controlled. A number of examples of the successful use of the experimental method are described, however. Brief sections are devoted to the description of the historical and statistical types of the observational technique.

This is not a book which practical marketing research men will be tempted to keep on their desks as a technical guide to their daily activities, but both they and those who teach the subject will do well to recall from time to time some of the ideas contained therein to the end that they may at all times be aware of the configuration and general location of the marketing research woods as well as of its individual trees with which they are by virtue of their daily work all too familiar.

R. S. Alexander

Columbia University

Sources of Current Trade Statistics, by Jettie Turner. Washington, D. C.: Bureau of Foreign and Domestic Commerce, United States Department of Commerce. Market Research Series No. 13. June 1937. vii, 47 pp. 25 cents.

The streamlined model of *Sources of Current Trade Statistics* brought out in June 1937, by the Bureau of Foreign and Domestic Commerce is as much improved over the previous edition (1934) as that edition was over the "Model T" original, published in 1933.

Designed "to list current economic statistics, with the name and address of each compiling or collecting agency," this directory catalogues statistics on production, machine activity, new orders, unfilled orders, sales, shipments, receipts, consumption, stocks, wholesale prices, retail prices, exports, imports, employment, payrolls and earnings, etc., for 20 main classifications. These classifications follow as far as possible the census classification of industries and include besides, sections on construction and real estate, electric power and gas, employment conditions and wages, finance, trade (domestic and foreign), and transportation and communication.

The 3,000 series listed are compiled by 240 governmental departments, trade associations, private research agencies, and technical or trade magazines and papers.

The job is a splendid one and will be received with thanksgiving by statistics seekers. Considerable thought has apparently been given to the problem of making the check-list usable. The format of the tables and the classifications and subclassifications used make for quick and convenient reference.

A few minor criticisms come to mind, many of which are recognized by the editors in their introduction. The answer to most of them is the restraint imposed by spatial limits and the desire for reference convenience. It is in a wistful spirit, therefore, rather than a critical one, that these points are raised.

First is the fact that in the case of several Government departments, the check-list refers only to the compiling bureau and not to the publication itself. The worst, and thus of course not typical, example of this is the eighteen publications of the Bureau of Foreign and Domestic Commerce, which are allotted only one reference number.

Again, prices of periodicals and reports are not indicated. In view of the heights which prices of some services have been known to reach, the question of price is at least pertinent.

For obvious reasons the directory omits data compiled by private agencies or associations when such data are available only to clients or members. And, succumbing to the emphasis on brevity, only original or compiling agencies are catalogued. Periodicals carrying desired data second-hand may in many instances be much more easily accessible than the report or press release of the compiling agency, particularly if that agency is located in another city. One notable exception is the *Survey of Current Business*, which the directory recognizes in every applicable instance by the addition of an asterisk to the reference number. From the liberal sprinkling of asterisks throughout the directory's 55 pages, it is possible to conclude that if one has the *Survey of Current Business* one is likely to get the largest possible footage of statistics per reference, for the *Survey* carries a majority of the series catalogued.

Finally, there is no way of telling from the directory whether a particular series listed is in actual values or amounts or has been converted into relatives or indices.

It is very probable that, after due consideration of alternatives, the present form and content were adopted as confining a maximum of conveniently accessible information in a minimum of space. It is pleasant to be able to report that the maximum of information and the minimum of space both seem to have been achieved.

EDWIN B. GEORGE

Dun & Bradstreet, Inc.

Expenses and Profits of Limited Price Variety Chains in 1936, by Malcolm P. McNair. Boston, Massachusetts: Harvard University. Publication of the Graduate School of Business Administration. Volume XXIV, Number 4. Bureau of Business Research, Bulletin Number 105. June, 1937. vi, 38 pp. $1.00.

This report analyzes the expenses and profits for 1936 of 33 limited-price variety chains operating 5,138 stores. These stores had aggregate sales of $815,000,000 and accounted for 92 per cent of this type of business in the United States. With this report the Bureau now has consecutive data on variety store operations for the six years beginning with 1931. Data are also available for 1929. Over 50 per cent of the sales of these stores were in apparel and accessories and household wares. Jewelry afforded the lowest sales volume.

The statistical summary of expenses and profits is made more effective with an interpretive analysis involving comparisons with department stores, year-to-year trends, analyses of factors affecting margin and expense and relative profit performance. The explanatory note at the close of the report will be helpful to those interested in the accounting and statistical procedure. This study was made with the co-operation of the Limited Price Variety Stores Association and is of definite usefulness to enterprisers in the variety store field. Moreover, this record of retail performance is of interest to other chain distributors as well as to other types of retail enterprise.

Price limit continues to be an important problem. Adding higher price items minimizes the promotional appeal of the low fixed-price limits. If the attraction of a wider range of merchandise and prices will offset this disadvantage the study concludes that: (1) gross margins will be lower; (2) total cost of business as a percentage of sales will tend to be lower; and (3) net profit as a percentage of sales will be lower because the decrease in the total percentage will not be as great as the decrease in gross margin.

Some of the interesting observations and conclusions of this report are:

(1) Variety chain stores made a better showing during the depression than did department stores, partly because of the pulling power of their fixed price appeal. With the return of some prosperity, however, consumers tended to shift their patronage to stores selling high-price merchandise, causing variety stores not to gain in the same measure as some other retail types.

(2) Gross margins increased but slightly in 1936. By way of comparison, the gross margin percentage increase for department stores was greater. The report raises the question as to whether variety chains will be able to maintain gross margins of the 1933–36 level without leaving an opening for competitors to accomplish something comparable to the inroads of the super-market on the grocery chain.

(3) Aggregate total expense indicated a small percentage decline. Department stores were able to realize greater decreases in expenses with greater increase in sales volume. Wage and hour problems in 1937 suggest that it will be difficult for variety chains and other retailers to get the expense average below the 1936 figure. It is stated that variety chains must discover methods of increasing the productivity of labor so that increased output will support the high wage rate.

(4) Variety chain net profit in the narrow sense was just under 5 per cent of net sales. More variety chains earned some net profit in 1936 than did department stores.

(5) Salaries and wages and occupancy costs accounted for more than 80 per cent of the costs of doing business in 1936.

(6) Advertising, an important cost for many retailers, amounts to less than 2/10ths of 1 per cent of sales.

The report summarizes year-to-year trends which embrace previous studies. Reports from seven companies show that average sales per store in

1936 of $186,000 were lower than the average sales per store in 1927 and 1929 although higher than the 1932 figure.

Sixteen identical companies reported operating results for 1929, and 1931–36. There was no severe decline in gross margin percentage during the depression; and beginning in 1933 there were increases in gross margin percentages. Expenses reached a high peak in 1933, with slight declines in each of the three following years.

In analyzing factors affecting margin and expense the report considers differences in size of company, size of average store, rate of stock turn, amount of average sales, and differences in size of cities. (The median figures are more important in this analysis as they weigh equally the experience of each firm as a management unit.)

This analysis of margins and expense indicates within limits:

Those enterprises making a relatively high proportion of their sales in apparel and dry goods had lower gross margins than did the companies specializing in the nickle and dime business.

Transportation costs on incoming merchandise were high for small chains and companies with low stock turn rates and companies located in smaller cities.

Size of chain did not greatly affect total expenses. Firms with high stock turns, however, had relatively lower wage and salary expenses.

The optimum size of sales transaction lies somewhere above the low point of the typical nickel and dime business.

In short, profits were best for chains with a large sales volume, a large number of stores, high average sales volume per store, fast stock turn, low average amount of sales transaction, and stores located in cities above the smallest population groups.

Total payroll as a percentage of sales was high for companies with low sales volume, small number of stores, low average sales per store low stock turn rates, low average amount of sales transaction, and locations predominantly in towns and cities under 25,000.

Tenancy costs were highest as a percentage of sales for chains with large sales volume, large number of stores, high average sales per store, high rates of stock turn and 50 per cent or more of their stores in cities over 25,000.

One section of the report reviews the relation of store expense to overhead expense. This section offers the interesting comment that salaries of officers, buyers, superintendents, and other executive personnel were a much lower percentage of sales than the salaries of store managers.

In discussing relative profit performance the report concludes that the superior profit advantage of the nine chains with the highest rate of net profit lay both in their higher gross margins and in their lower percentages for total expenses.

KENNETH DAMERON

Ohio State University

Operating Results of Department and Specialty Stores in 1936, by Carl N. Schmalz. Boston, Massachusetts: Bureau of Business Research, Harvard University. Publication of the Graduate School of Business Administration. Volume XXIV, Number 3. May 1937. Bureau of Business Research Bulletin Number 104. vi, 38 pp. $2.50.

This series of annual reports on the margins, expenses, and profits of department and specialty stores is well known to most readers of the JOURNAL. In the September, 1936, issue, the two previous studies in the series were capably reviewed. Therefore, attention will now be directed to the changes which have been made in the present report, to the trends noted through an analysis of the 1936 data, and to the suggestions made to store executives.

The detailed treatment of year-to-year trends has been omitted. Many comparisons with previous years are made, however, in the summary and conclusions section. Although comparative data by years are not given in tables as previously, still the exposition furnishes an excellent picture of trends, and both space in the publication and time of the reader are conserved. Those who wish to work with data of other years can refer to previous reports. A new expense division has been added to the expense breakdown. It is "Percentages of Net Credit Sales." There are three subdivisions as follows: (1) pay roll: accounts receivable and credit; (2) losses from bad debts; (3) interest on accounts receivable. "The total of accounts receivable and credit pay roll, losses from bad debts, and interest on accounts receivable outstanding for the five groups of department stores with sales of $1,000,000 or more ranged from 3.45% to 2.8% of credit sales. For specialty stores with sales of $2,000,000 to $4,000,000 the total was smaller, 2.4%. Accounts receivable outstanding (averages of balances at the beginning and end of the year) typically were from 22% to 27% of credit sales for department stores, and from 18% to 21.8% for specialty stores."

Sales in both department and specialty stores continued to increase in 1936. In the ten groups of department stores studied, the increase ranged from 7.6 per cent to 13 per cent with larger increases in the larger stores. For department store business "the great depression is definitely a matter of history." Dollar sales in 1936 were roughly 16 per cent below the average level of 1929, but physical volume was 7 per cent above 1929 and but 2 per cent below the all-time high established in the first six months of 1931. Profits likewise increased markedly, occasioned largely by lower expense and by a higher maintained markup. The gross margins taken by the stores did not change appreciably, but they did not find it necessary to take as great markdowns, thus achieving a higher maintained markup. The expense percentage was lower as a result of increased volume without a proportionate increase in expense. The author notes that the 1936 pay roll was not influenced by union activity in the retail field but that higher pay roll costs may appear in 1937.

The suggestions made are largely in regard to the need of further study.

Problems occasioned by the depression are a thing of the past, but the older problems are still present and, perhaps, in an aggravated form. Among them are competition with other forms of retailing, a revision of service and service costs in conformance with consumer desires, employe relations, and the ever-present problem of making adjustments in anticipation of changes in business conditions. With department and specialty store business at high tide, executives should "get ready for the difficulties which lie ahead."

D. M. PHELPS

University of Michigan

The Physical Distribution of Fresh Fruits and Vegetables, by Edward A. Duddy and David A. Revzan. Chicago, Illinois: University of Chicago Press. Studies in Business Administration, Vol. VII, No. 2. 1937. ix, 92 pp. $1.00.

This monograph is divided into four parts: "Economic and Social Bases of the Commercial Fruit and Vegetable Industry," "The Growth of the Commercial Fruit and Vegetable Industry," "The Market Distribution of Fruits and Vegetables," and "The Chicago Wholesale Market for Fruits and Vegetables." Data going back as far as 1899 are given for the more important items (pp. 28–47). Reasons for the growth of the commercial traffic in these products are given (Chapter I), together with a short review of consumer attitudes (pp. 82–4) and the influence of the truck (pp. 78–82).

The main purpose of the study, however, is to show the origin and destination of the fresh fruit and vegetable industry, changes in movement, and over-all shifts in per capita consumption as measured primarily by commercial production or unloads, giving special attention to the Chicago market as a center for redistribution as well as consumption.

From the point of view of many different groups interested in such data, the most important figure in the marketing of any fresh fruit or vegetable is that of per capita consumption and, if possible, the trend in per capita consumption. The authors generally discard estimates of total production of the Bureau of Agricultural Economics, which "while corrected to exclude quantities produced but not harvested, necessarily include that part of the crop which is canned or dried, the culls or surplus used for by-product manufacture, and that part of the crop which was consumed locally and not shipped." Although total estimates alone are available for some of the crops, commercial figures are presented for the majority since 1918 and "are thus the best index of the growth of the industry" (p. 26).

Like total estimates, railroad car shipments are inadequate because "the record of rail shipments has ceased to be an adequate measure of the volume of movement of many commodities to wholesale markets since 1927 because of the inroads of the motor truck into the perishable freight business of the railroads" (pp. 26–7).

The authors wisely accept, as the best measure of the growth of the industry, per capita consumption, using, where possible, production data corrected for imports and exports (p. 27). The question immediately arises, however, whom to include and whom to exclude under the head of "per capita." The authors use total population for staples and urban population for all others. The simplicity of this method is obvious; its soundness, however, may be questioned. Rural populations, according to Census statistics, include those living in towns of 2,499 people, to say nothing about smaller places, suburbs, and farming areas immediately adjacent to "cities" or "towns." For various reasons, stores—particularly chain stores—located in these regions handle most, if not all, kinds of fresh vegetables and fruits, even though the per capita consumption is undoubtedly lower. Racial characteristics, difference in incomes, age, sex, and possibly a number of other factors may have a decided bearing on the consumption of fresh vegetables. Such considerations would lead to a more refined result, figures which would be of more value to the local rather than to the national distributor, social scientist, dietician, and others interested in this subject. Per capita figures for the nation as a whole represent a start; breakdowns by trading regions must be made before they are of maximum commercial value.

As a step in this direction, regional (nine census divisions) breakdowns are given for carlot shipments of 18 fruits and vegetables to 66 markets, together with the origins of these same unloads. The presentation of these data naturally leads to the discussion of the deficit and surplus regions for these commodities, combined (Chapter III).

In discussing the Chicago market, the authors state that "in general, one may say that the commodities which have been brought closer to the market by a change in the method of transportation (talking about the motor truck) are those which have a wide range of adaptability to soil and climate." The truck has built up production nearby of those crops which can be locally produced (p. 79).

With less assurance, the authors find that consumer preferences have also changed the production pattern. A swing from the Wisconsin to the Idaho potato is cited. A desire for a longer season broadens the producing area serving any large city. They add: " . . . the geographical pattern of supply of fruits and vegetables for the Chicago market is most unstable. A change in price level or a revision of freight rates may easily result in rearrangement of the major sources of supply as far as the Chicago market is concerned" (p. 84).

The authors conclude:

> "It should finally be noticed that, though per capita consumption of potatoes and apples is declining, these two bulk large in number of pounds consumed annually. Oranges have displaced apples in this respect. As annual consumption figures, the per capitas of the remaining commodities must be considered low enough to allow for still further expansion consistent with favorable price conditions and the expressed preference of the consumer" (p. 92).

The value of this excellent monograph lies not so much in the per capita consumption figures as in the attempt to arrive at some practical data. In the field of distribution there are still too many general tomes, describing institutions, functions, and commodities, and entirely too few short analytical monographs. Consumption data of real value can only be obtained when students in the field carefully check every figure, analyze every idea, and draw no general conclusions. Authors Duddy and Revzan have taken a forward step in this direction with the publication of *The Physical Distribution of Fresh Fruits and Vegetables.*

WILFORD L. WHITE

Bureau of Foreign and Domestic Commerce

The Objective Rate Plan for Reducing the Price of Residential Electricity, by William F. Kennedy. New York: Columbia University Press. 1937. x, 83 pp. $1.25.

The objective rate plan was formulated by the Commonwealth and Southern Corporation and was first introduced by its subsidiary, the Alabama Power Company, on October 1, 1933. The principles of the plan have subsequently been adopted by 56 other electric utilities operating under the jurisdiction of 28 state commissions. This plan is the most recent and promising device to encourage increased consumption of electric energy, thus making possible lower unit costs and lower rates. Its principal vogue has thus far been in the residential field.

The objective rate plan provides for two simultaneously effective rate schedules: the immediate rate, a schedule designed to protect the company from the loss of revenue that would occur if rates were reduced without a corresponding increase in the sale of electricity; and the objective rate, a lower rate which applies to those customers whose consumption is increased by specified amounts over the consumption of a base period. As applied by the subsidiaries of the Commonwealth and Southern—"Base bills are determined for each consumer by applying the immediate rate to the consumer's actual consumption in each of the twelve months preceding the inauguration of the plan. Whenever a bill under the immediate rate equals or is less than the consumer's base bill, the immediate rate applies. Whenever a bill under the objective rate exceeds the base bill, the objective rate applies. Whenever the immediate rate results in a bill greater than the base bill, and whenever the objective rate results in a bill less than the base bill, the base bill applies."

Mr. Kennedy finds the origin of the plan in the dilemma presented by demands for rate reductions during the depression, when the loss of industrial load had already imposed serious shrinkages in total revenues and when rate reductions not offset by proportionate increases in sales were financially dangerous to the utilities. The immediate occasion for the inauguration of the plan was supplied by the imminent competition of the T.V.A. and by a commission order requiring the reduction of rates to domestic consumers.

The more general characteristics of the 56 operating plans are described; but the absence of data for the more recently installed plans compelled the restriction of the analysis of the results under the plans to six southern operating companies of the Commonwealth and Southern Corporation. Although economic recovery, changes from less desirable rate forms to promotional block schedules, rate reductions, and aggressive campaigns for the sale of appliance are all recognized as disturbing factors, the objective rate plan is reasonably credited with achieving large gains in the sales of domestic electricity, the average annual consumption per residential customer exceeding 1,000 kilowatt hours, and making possible a reduction of the average charge from 5 to 3¼ cents per kilowatt hour for domestic electricity. The plan was successful in protecting the absolute level of residential revenues, and, after a first-year decline in revenues per customer, this index also showed steady improvement. The discrimination implicit in the plan—when two customers having the same total consumption pay different bills if one has a smaller base use—is held to be justified by the larger benefits to the entire body of consumers.

Though his study is necessarily limited by the availability of data, Mr. Kennedy's presentation, commendable for its conciseness and clarity, should aid utility executives, regulatory authorities, and consumers to appreciate the potentialities of the objective rate plan as a means of protecting utility revenues while stimulating that increased utilization of service which can bring lower costs to the companies and lower rates for consumers.

IRSTON R. BARNES

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A Study of Fluid Milk Prices, by John M. Cassels. Cambridge, Massachusetts: Harvard University Press. Harvard Economic Studies, Volume LIV. 1937. xxvii, 303 pp. $4.00.

It is seventeen years since Clyde L. King, who has just passed away, published his pioneer monograph, "The Price of Milk." Comparison of his conclusions, based on first-hand experience in milk arbitration, with the conclusions reached by John M. Cassels in his comprehensive appraisal of milk prices, is a good index of the economic and statistical progress made in this field in the intervening decade and a half. Perhaps more than in any other monographic study of an individual commodity yet published, Dr. Cassels has blended theoretical economic analysis with statistical appraisal of the significance of that analysis. If the result is not completely satisfying, it is because at many points in the field statistical studies are as yet only suggestive of the true relations, and hence definite conclusions on many points have to be left in abeyance.

The most stimulating parts of the book from the point of view of the professional price analyst are the first five chapters. In these chapters the neoclassical economic analysis is applied with skill and discrimination to the exceedingly complex problem of the interrelationships of prices among the several products into which milk may be made, the interrelationships of producers', market, and retail prices, and the production reactions. The theoretical analysis of the geographic distribution of the "disposal response," or use of the milk for various purposes in the areas around one or more markets, is a distinctive contribution to the theory of the geography of prices. Much of this analysis has already been published in various professional journals, but it is here brought together in clear-cut and compact shape and will prove significant not only to students of milk prices as such but also to students of general economic theory.

The analysis of the conditions with respect to the elasticities of demand for fluid milk and other products which make price discrimination possible is also well developed. The institutions that have developed in the field, particularly cooperative marketing organizations and the pricing plans and bargaining methods used by them, are clearly and coherently related to this analysis.

The next portion of the book deals with the statistics of the industry. In describing the geographic picture of production and consumption, some unique charts are introduced which show the balance of production, disposal, and consumption as between manufactured products and fluid milk. Many statisticians will feel that these charts show too much in a single diagram and that a series of charts to show the relations depicted would be more intelligible to the average reader.

The balance of the book is devoted to an examination of the statistical evidence on the demand and supply of milk and its products; and on the geographic development of the industry, especially in the northeastern markets and in New England; in the light of the hypothesis developed in the first part. This analysis shows in general that the demand for fluid milk is very inelastic, that dealers' margins and transportation rates tend to be inflexible, resulting in even less elasticity of demand in the price to the producer than in retail prices; that the response of milk production to prices offered shows some evidence of responding according to theory but with conflicting results for different periods; and that the geographic distribution of marketing areas and production zones follows in general that to be expected from the theoretical analysis, though with areas by no means as precisely separated as indicated by the theory. Under the study of price relations two interesting maps of the geography of milk prices and butter prices are presented, and evidence is developed to show the existence of a consistent national price structure for butter and other manufactured products and a less consistent national price structure for fluid milk.

Finally the actual price for fluid milk in the various city markets is compared with the theoretical price based on the price of butter and cream at the edge of those markets, and the conclusion is reached that the existence of farmers cooperative organizations and discriminative pricing systems has resulted in maintenance of fluid milk prices in those markets materially above the price that would have prevailed under free competition, with the extent of the monopoly gain in different markets correlated with the strength and vigor of the several cooperative marketing organizations.

Dr. Cassels states that the study has been little changed since it was submitted as a doctor's thesis in 1934. This is unfortunate both in that the statistical data are not carried beyond early 1933 and in that the text still includes some details of statistical compilation which, for general readers, might better have been relegated to the appendix. Even so, the writing is clear and concise. Even if the data had been carried down to date, the general conclusions would probably have been little changed.

Two details of technical statistics may be noted. In discussing an earlier study where one variable was correlated with the values of another variable for 12 months earlier, Cassels says that this should be described by saying the earlier variable was "advanced" 12 months rather than saying it was "lagged" 12 months. "Lag," according to the dictionary, means "to fall behind." Obviously the production response lags behind the price. If the price is to be placed at the same period of the resulting production response, it must then be "lagged" to the same extent. Where the value of a given variable is used for a period materially behind its true period, it is thus, I believe, better terminology to refer to the value as a "lagged value," since it is moved to a date subsequent to its actual period.

In his examination of statistical analyses of production responses, Dr. Cassels recalculates a study of Vermont milk production which had been made by the present reviewer. The original study covered the period 1917 to 1925. In the new study, Dr. Cassels finds that factors which showed a significant relation to production before showed no significant relation in the period he examines, 1921 to 1931. The years 1917 to 1920, when there were marked variations in both production and prices, were eliminated from this test "in view of the abnormal conditions prevailing between 1917 and 1920." In part, the divergence of results may be due to the improvements in technique which Dr. Cassels introduces and to a bias in calculation which he believes he has found in the earlier study. It is not surprising, however, that economic forces which explain changes in years of violent change, as during and shortly after the war, should prove less significant in years of relatively stable production. When the data for the recent depression and recovery period can be included in the study, it may be found that production during this last "abnormal period" responded to price stimuli just as it had during the earlier period that Dr. Cassels excluded from consideration.

As a whole this is an excellent piece of work, covering both the theoretical and practical economic situation for a given commodity in well-rounded style, setting up hypotheses for the statistical examination carefully and critically, and checking back the extent of agreement between the statistical data and the economic hypotheses. It reflects credit not only on the author but also on John D. Black, whom Dr. Cassels credits for the guidance of the project. The general conclusions reached, that milk and dairy products show as a whole the existence of a competetive market except in fluid milk areas where cooperative marketing organizations and pricing plans have intervened, and that in those cases there have been important monopoly gains, seem well substantiated. No attempt is made to discuss the ethics of these monopoly gains or to consider whether consumers benefit, in the long run, from paying them.

This is an important book and one which will be useful to many students in many fields. It is to be hoped that similar comprehensive analyses of production and prices will become available in the years ahead for both agricultural and industrial products. To the extent they do, they will change the teaching of economics in the direction of realism and objectivity and provide a far firmer scientific basis for the economic art.

MORDECAI EZEKIEL

Washington, D. C.

Butter and Oleomargarine: An Analysis of Competing Commodities, by W. R. Pabst, Jr. New York: Columbia University Press. London: P. S. King & Son, Ltd. 1937. Studies in History, Economics and Public Law. Edited by the Faculty of Political Science of Columbia University. Number 427. 112 pp. $1.50.

This book gives a brief summary of the development of the butter and oleomargarine industries in the United States, a survey of oleomargarine legislation, a theoretical statement of the interrelationships of the two commodities, and a statistical study of the interrelationships based on annual data for the period 1921–34. This background gives a basis for appraising the possible effects of recent proposals for oleomargarine legislation, if enacted.

Chapter I gives a history of the industries, with the emphasis on the principal technological developments that have affected the production of butter and oleomargarine. It is stated in this chapter that "the United States standard for fluid milk is that it should contain 3.5 per cent by weight of butterfat." There are no Federal standards for the butterfat content of milk. The Bureau of Agricultural Economics estimates that the average butterfat content of all milk produced in the United States is about 3.93 per cent and that the average test of milk used in the production of butter is somewhat higher than the average. It takes about 21 pounds of milk to make a pound of butter.

Chapter II is an excellent summary of oleomargarine legislation written from an economic point of view. The chapter is entitled "Restraint of Competition between Butter and Oleomargarine."

Objections could be raised to the statement that butter and oleomargarine are similar products. The similarity or difference depends upon the criteria by which they are judged.

In the statistical analysis, data on consumption of butter ("apparent disappearance") are used. The author uses consumption of butter as an independent and as a dependent variable in determining the interrelationship between prices and consumption of butter and oleomargarine, time, and per capita income.

In stating the causal relationship between these factors, there are some objections to using butter consumption as an independent variable. The year-to-year variations in butter consumption ("apparent disappearance") are due primarily to variations in butter production. In the 14-year period 1921 to 1934 there were 9 years in which consumption differed from production by less than 1 per cent and 3 years in which the difference was between 1 and 2 per cent. In 1933 consumption was 4.1 per cent less than production, and in 1934 consumption was 2.6 per cent larger than production. These differences in 1933 and 1934 were due in large part to the Government purchases of butter in the last 5 months of 1933 that were put in storage and distributed for relief in the first half of 1934.

There would be some justification for omitting the years 1933 and 1934 from the analysis because of the effect of Government purchases.

Because of the close relationship between the volume of production and the volume of consumption of butter, it would be more accurate in stating the causal relationships to think of butter production as the independent variable and butter consumption as being in very close adjustment to production, on an annual basis.

It is suggested on page 76 that, when fluid milk consumption decreases in times of depression, butter production tends to increase because of the greater volume of "surplus milk" diverted to butter production. This is, of course, true in fluid milk markets. In the Corn Belt, where the major proportion of the butter is produced and where relatively little milk is used for fluid use, dairying competes with the production of hogs and cattle. Studies made in the Bureau of Agricultural Economics indicate that in Iowa the major changes in butter production are due to changes in the relationship between butterfat prices and hog prices. High prices of butterfat in relation to hogs stimulate butter production. Feed supplies and pasture conditions also affect butter production. Changes in consumption of fluid milk do affect butter production, but the major fluctuations in butter production in the past 15 years have been due to other factors.

The last chapter of the book is an analysis of the proposals for further oleomargarine legislation proposed by the National Cooperative Milk Producers' Federation.

E. E. VIAL

Bureau of Agricultural Economics
U. S. Department of Agriculture

The Theory of Statistical Inference, 1936–1937. Lectures by S. S. Wilks, Princeton University. Ann Arbor, Michigan. Planographed by Edward Brothers. 1937. iii, 106 pp. $1.50.

These lectures present the main notions involved in the theory of statistical inference in a clear and elegant manner.

The elements of probability theory that are given in Chapter I are essential as a foundation for the basic principles and theorems of sampling theory. For the purposes of the theory of statistics, *probability* is regarded as a concept which depends for its meaning on aggregates of phenomena or repeated events. The aggregates are regarded as unlimited sequences of events and are called "statistical universes" or "populations."

Of special interest from a logical point of view is the explicit statement of certain assumptions regarding populations from which the usual laws of probability can be obtained as consequences of certain operations on the populations. In particular, assumptions are stated which underlie the notion of *probability density*. Next, the concepts of mean and variance are presented, and several important theorems regarding mean values and variance are developed. The manner in which the rules for combining probabilities may be regarded as operations on populations is discussed in terms of the following operations on populations: (1) random selection, (2) mixture, (3) partition, (4) conjunction.

Chapter II deals with general notions of sampling theory. This includes an elegant development of the law of large numbers based on Tchebycheff's inequality; the normal approximations to the binomial and multinomial distributions; the geometrical development of the χ^2 distribution, and the Poisson distribution. The chapter includes also the development of various methods for determining the sampling distributions of certain statistics. These include the determinations by characteristic functions, by moment equations, and by geometrical devices.

The chapter on the estimation of population parameters starts with the definition of a *statistic* as a function of the variates supplied by a sample for estimating a population parameter. The meanings of the three fundamental criteria of a statistic—consistency, efficiency, and sufficiency—are presented.

The Pearson and the Gram-Charlier systems of frequency curves are considered with special reference to the consistency of their parameters estimated by the method of moments. The method of maximum likelihood for determining optimum estimates is developed and applied to a few examples, where, by an optimum estimate, we mean a statistic that satisfies the three criteria mentioned above. The chapter closes with an excellent treatment of the estimations of parameters of the regression functions including the determination of sampling errors.

Up to this point, the lectures have considered deductive problems, that is, they have been concerned with methods of finding distributions of statistical functions computed from samples drawn from populations whose distributions are specified both with respect to form and parameters. But, from the standpoint of statistical inference, the most direct and crucial problems consist in arguing from samples and their statistics back to populations and their parameters. This class of problems is dealt with in the last two chapters. In this class of problems, conclusions are usually stated in terms of probabilities rather than in certainties. It is in this connection that controversies have arisen in the so-called inverse probability theory. In the present lectures the controversial questions centering around assuming a constant distribution of probabilities in the initial situation are avoided and the method of fiducial inference initiated by R. A. Fisher is developed in an interesting manner. This method serves mainly to test a hypothesis for rejection under the assumption that it is true. The final chapter deals with the Neyman-Pearson theory, which deals not only with criteria for the rejection of hypotheses assumed to be true but also with the rejection or acceptance of other types of hypothesis such as the probability of the acceptance of hypothesis which is false.

The illustrative examples are well chosen and serve to make the lectures more readable at many points than they would otherwise be.

H. L. RIETZ

University of Iowa

The Mathematical Problem of the Price Index, by J. K. Montgomery. London: P. S. King & Son, Ltd. 1937. 74 pp. 6*s*. 0*d*.

This little book of only 74 pages, packed with mathematical formulae, may well be considered as a major contribution to the *theory* of index numbers.

My chief adverse criticism is the use of the word "the" rather than "a" in the title; for there are many other and fundamental mathematical problems of price indexes besides the particular one to which Mr. Montgomery gives his sole attention.

Another criticism is that he seems unable to crystallize "the" problem into a simple and clear-cut statement in words. This he admits. On the first page he says: "The following statement of what the writer puts forward, without claiming any originality for it, as the most satisfactory conception of the price index can hardly be called a definition, as he proceeds by first expressing the conception in vague terms and afterwards trying to give a more precise meaning to those terms."

On the next page he says: "Comparing the commodities in the given year with the commodities in the base year, we note that both prices and quantities have changed. The aggregate value is partly due to the changes in price and partly to the changes in quantity."

On page 8 he says: "We have now to make clear what we mean by 'the change in the aggregate value due to the changes in price' and 'the change in the aggregate value due to the changes in quantity'."

The author reaches precise results in mathematical terms but seems never able to state the meaning of "due to . . . " in words. The nearest approach seems to be on pages 18, 19, 20, where he mixes words and formulae as follows:

"In the equation [expressing a product of factors as equal to a sum of terms] .... let ...... where .... is such that adding .... contributes as much to the sum ....

as multiplying .... contributes to the product .... Hence we may say that .... represents the change (measured as a difference) in .... *due to the change* from .... to ...., and so on. Thus we can transform the difference ...., which is the increase of .... *due to the change* of .... to .... and so on, into the sum of a series of terms .... of which .... represents the increase of .... *due to the change of* .... to .... (simultaneously with the change of .... to .... and so on). .... represents the increase of .... *due to the change of* .... to .... (simultaneously with the other changes) and so on." [The italics are the author's.]

There are not, in the entire book, any other passages which could be quoted in this review as showing the meaning of the problem of the book; and the passages just quoted are from three separate pages interspersed with formulae, occupying most of the space, which formulae, if quoted here, without their background in the preceding pages, would be unintelligible.

It will be seen that Mr. Montgomery regards the problem of index numbers as one of translating a sum such as Σpq into a product such as PQ.

The author's problem is at bottom substantially the same as that involved in the problem of logarithms, by which an "arithmetical" series of numbers succeeding each other by equal differences corresponds to a "geometrical" series of numbers succeeding each other by equal ratios.

Consequently the author's result involves logarithms and exponents. If the prices in the base year are p_0, p_0', p_0''—and the associated quantities (multipliers, often miscalled "weights") are q_0, q_0', q_0''—the author's new index number, P_{01}, of prices is (page 32):

$$P_{01}=\left(\frac{\Sigma p_1q_1}{\Sigma p_0q_0}\right)^{\frac{\Sigma(p_1q_1-p_0q_0)\{[\log p_1/p_0]/\log (p_1q_1/p_0q_0)\}}{\Sigma(p_1q_1-p_0q_0)}}$$

with a corresponding formula for Q_{01}.

This result is a matter of great theoretical interest for all students of the mathematical theory of index numbers. Like the curious formula invented by the late Professor Allen Young,[1] it cannot be classified under any of the classifications into which fall all the nearly 200 formulae discussed in my *Making of Index Numbers.*

It suggests an entirely new class built around the idea of operating on:

$$\frac{\Sigma p_1q_1}{\Sigma p_0q_0}.$$

Mr. Montgomery compares his formula with what I called the "ideal" formula, namely:

$$P_{01}=\sqrt{\frac{\Sigma p_1q_0}{\Sigma p_0q_0}\cdot\frac{\Sigma p_1q_1}{\Sigma p_0q_1}}.$$

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[1] See "Fisher's The Making of Index Numbers," *The Quarterly Journal of Economics*, February 1923.

This may evidently be so written as to contain, more explicitly, the magnitude $\Sigma p_1q_1/\Sigma p_0q_0$ with which Mr. Montgomery starts.

He points out that his index lies between the two limits $\Sigma p_1q_0/\Sigma p_0q_0$ and $\Sigma p_1q_1/\Sigma p_0q_1$, and comments:

"This explains why Professor Irving Fisher's 'ideal' formulae . . . give a very good approximation . . . since they are the geometrical means of the limits between which P_{01} and Q_{01} must lie."

For the one case which he works out arithmetically, his formula gives 161.74 and the ideal, 161.56, the difference being .18 or almost exactly one-tenth of one per cent.

Mr. Montgomery's formula fulfills the important "time-reversal test" as well as the "factor-reversal test." He does not discuss the other tests except the circular test which neither his formula nor the "ideal" fulfills—though, theoretically, that failure both he and I find to be a virtue rather than a defect.

Mr. Montgomery's study may conceivably lead the way to other interesting results in index number theory. But, for the present, his formula is a "tour de force." It is not usable in practice, requiring as it does far more laborious calculations even than the "ideal" formula, which, in its turn, is seldom of practical use since the extra refinement it yields is seldom worth the extra calculations required.

From a practical standpoint the simple aggregative $\Sigma p_1q_0/\Sigma p_0q_0$, to which Walsh gave the name of "Laspeyres' formula" since Laspeyre seems to have been the first to use it (in 1864), probably gives as great accuracy as is usually needed.

This formula is gradually winning its way and replacing all other weighted formulae, while, among unweighted formulae, the simple geometric is apparently superseding the simple arithmetic, for reasons described in my book.

Thus theory and practice are far apart. Mr. Montgomery has definitely contributed to the former but not the latter.

IRVING FISHER

Yale University

On the Statistical Theory of Errors, by W. Edwards Deming and Raymond T. Birge. Washington, D. C.: The Graduate School of the United States Department of Agriculture. (Reprinted from *Reviews of Modern Physics*, July 1937, with additional notes dated 1937.) Pp. 119–161. 35 cents.

It is very gratifying to see this article made available for more general distribution. Written in a remarkably clear and concise style, it treats most of the important phases of the modern theory of errors.

After an introduction, which sketches the background of the subject, the authors proceed to the development and description of the frequency distributions of the statistics u (deviation of sample mean from population mean), s (sample standard deviation), and z $(=u/s)$, in samples from a normal population. The use of these distributions in making the ordinary tests of hypotheses about the parent population is then explained—tests which determine the probability that the given sample could have been drawn from a population having a proposed mean and a proposed standard deviation. In this connection, the question of fiducially related values of σ (population standard deviation) and s is discussed.

In dealing with the problem of estimation, the writers consider the method of maximum likelihood, empirical estimates, and the posterior method, making quite clear the underlying assumptions of the different methods. The important question of the reliability of various estimates is carefully treated.

To be commended is the placing of a complete list of symbols, with explanations, at the beginning of the article.

The only adverse criticism concerns the typography, which, although in general excellent, is somewhat marred by the columnar arrangement. There is a frequent shifting, when a long formula occurs, from two columns to one and back again. This gives a displeasing appearance to the page and is also slightly confusing to the reader.

On the whole the monograph is excellent and its study is earnestly to be recommended to those desiring an introduction to the modern statistical theory of errors, or those seeking to clarify their ideas on this subject.

PAUL R. RIDER

Washington University
Saint Louis

Statistical Analyses of Industrial Property Retirements, by Robley Winfrey. Ames, Iowa: Iowa State College. Publication of the Iowa Engineering Experiment Station, Bulletin Number 125. December, 1935. 176 pp. Free.

In this exhaustive study of methods of estimating the service life of physical property, five different procedures are considered for assembling data for constructing survivor curves from which the distribution of length of service life can be determined. These procedures are devised so as to be applicable to the following most commonly used types of records which are kept regarding the installation and retirement of units of property:

(1) Records showing only the number of units retired during a given year or series of years, together with the age of each unit at retirement.
(2) Records in which the number of units placed in service during a given year (or some other period) is known, together with the number of these units remaining in service at successive later observation dates.
(3) Records in which an original group is too small to be very reliable, or when retirements do not produce a satisfactory survivor curve.
(4) Records in which the number of units in a group of units placed in service during each of several years is known, together with the number of units remaining in each group at successive later observation dates.

(5) Records giving the number of units retired during the period of observation and their ages at retirement and the number of units in service at the beginning of the observation period and their ages.

The five procedures devised by the author are applied to many varieties of industrial property, including gas meters, telephone poles, distribution transformers, railroad boxcars, trestles, crossties, etc. From a consideration of 176 survivor curves, 18 typical survivor curves and their mathematical equations are developed. From each of the survivor curves are also derived the curve of probable life (of units surviving at a given age) and the frequency curve of length of life. The author has used Pearson's curves and Gram-Charlier series for fitting his frequency distributions and the Gompertz-Makeham function for fitting the survivor curves. The technical operations and data involved in fitting these curves are given in three detailed appendices.

This study is rather well organized and has been made with care rivaling that used in many human mortality studies. A noteworthy feature is a well-defined terminology which makes it easy to follow exactly what the author has done. The bulletin embodies the results of laborious calculations, many of which are carried to seven and eight decimal places. This appears somewhat unnecessary in some cases in view of the fact that some of the samples have less than 100 observations in them. In other cases, however, in which 100,000 or more units are available, there is some justification for the more refined calculations.

There are various complicating factors which are not considered by the author, the main ones being salvage value, obsolescence, and improvement of quality of equipment. His methods, however, should prove useful in arriving at a more precise system of accounting for depreciation of physical equipment that is not significantly affected by these factors during its lifetime. More specifically, the procedures should be valuable to those public and private enterprises in which many similar units of equipment are used.

S. S. WILKS

Princeton University

Mathematics of Finance, by D. H. Mackenzie. New York & London. McGraw-Hill Book Co., Inc. First Edition. 1937. ix, 313 pp. Including *Compound Interest and Annuity Tables*, by F. C. Kent and M. E. Kent. First Edition, Seventh Impression. 1926. viii, 214 pp. $3.75.

The subjects treated are those usually found in textbooks on business mathematics. Somewhat off the beaten path and highly commendable are Chapter I presenting the "Economic and Legal Aspects of Interest" and two Appendices devoted to practical applications of amortization.

The minimum essentials of algebra are given in the first two chapters. The presentation of logarithms leaves considerable to be desired. The discussion on page 37 "Finding the Logarithm of a Negative Quantity" is unnecessary and only serves to complicate the use of logarithms for the student. The complication reappears throughout the book wherever the term of an annuity is found with the aid of logarithms.

The development of simple and compound interest is on the whole adequate but is marred at several points by loose wording. Particularly noticeable is the failure to distinguish "number of conversion periods" and "length of conversion period" at the beginning of Chapter V. On page 70 the author appears not to realize that straight-line interpolation in the compound interest table for fractions of a conversion period is the equivalent of computing simple interest for the fractional part of a period. The use here and elsewhere in the book of the expression "If interest is compounded" meaning "If interest is compounded at intervals of less than one year or one payment period" is confusing to the reviewer. Perhaps it will not be found so by others. Equation of Value is discussed entirely as a problem in compound interest, whereas in practice simple interest for short periods of time is used more often than compound interest.

The explanation of the principles of annuities, which requires 106 pages, is quite unique. The author states:

> There are seven general cases of annuity computations each of which requires a different equation for the solution:
>
> 1. Payments annually—interest annually.
> 2. Payments annually—interest compounded.
> 3. Payments p times a year—interest annually.
> 4. Payments p times a year—interest compounded.
> 5. Payments p times a year—interest compounded, but $m = p$.
> 6. Payments at intervals greater than 1 year—interest annually.
> 7. Payments at intervals greater than 1 year—interest compounded.

Each of these seven cases is illustrated for the finding of each of the terms of the annuity equation for accumulation and present value of terminal annuities, and annuities due. These examples, which are intended to be the feature of the book, will prove to be its besetting sin, because students in solving problems will thumb the pages of the book in search of a similar illustration instead of trying to analyze the conditions of their problems. The equation of case 4 can, of course, be used to solve any annuity problem, if the symbols are properly defined. The development of six variations of the equation as separate cases introduces an atmosphere of complexity into the subject of annuities which is unwarranted.

Amortization of debts and the accumulation of sinking funds is well presented, except for the omission of the case of amortization in which the time for the debt to be paid is unknown. The treatment of bonds is somewhat incomplete and is marred by an unfortunate error in computing the "and interest" value of a bond bought between coupon dates. The accrued interest at the market rate instead of the coupon rate is added to the "flat" value instead of being subtracted from it to get the "and interest" value. The symbol $v_{\overline{n}|i}$ for $(1+i)^{-n}$ is used in the bond formula without explanation but appears at no other place in the book.

The chapters devoted to insurance are the best presentation in the book.

The explanation of the different types of insurance and the computation of single and annual premiums for simple examples prior to the introduction of the commutation notation is commendable as a teaching device.

The value of the book is greatly enhanced by the inclusion of the Kent 10 place tables of the interest and annuity functions.

M. A. BRUMBAUGH

University of Buffalo

Business Statistics, by George R. Davies and Dale Yoder. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1937. vii, 548 pp. $3.50.

Business men and students of statistics who are interested in the business point of view will welcome this book as a step forward in the business textbook field. The purpose of the book as expressed in the preface is a very desirable one—that of presenting statistical techniques in such a way that the business man and the student may know both the application and its limitations.

The student may indeed obtain a good knowledge of statistical method from this textbook. The description of methods throughout is presented in a clear-cut, straightforward style. The illustrative problems are sufficiently simple to make it as easy as possible for the student to grasp. At the same time, the illustrations are taken from actual social or business setups.

The problems presented at the end of each chapter are in themselves intelligent, well thought out questions. They illustrate, however, the chief weakness of the book. They will not stand on their own merit. Unless the teacher of this book uses it with ingenuity, it is no better than any other run-of-the-mill textbook on statistics. For example, on page 271 are problems on time series analysis. Problem 2 presents freight car loadings by quarters from 1923 through 1930. The student is asked to prepare a time series analysis of the data. Such an analysis is of doubtful value to most businesses. The problem is not one which will arouse much interest on the part of the student. In other words, it is entirely up to the instructor as to whether or not the student will derive any practical value from such a problem.

The second weakness of the book is connected closely with the weakness of the problems. It is disappointing to read a book entitled *Business Statistics* and find that only one chapter is devoted to a discussion of the actual application of statistical analysis to business problems. Granted, the student must first have a working knowledge of his tools. He can get this from *Business Statistics*. After acquiring this knowledge, however, he wants to know where to use each tool or combination of tools. An expansion of chapter ten would be desirable. A discussion after each chapter showing fields of business where particular methods are applicable would have strengthened the book from the business point of view even more.

FRANCES V. SCOTT

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Harvard University

Statistical Tables: Their Structure and Use, by Helen M. Walker and Walter N. Durost. New York: Bureau of Publications, Teachers College, Columbia University. 1936. v, 76 pp. $1.60.

This is a practical, small but nevertheless inclusive, book for the aid, primarily, of students doing educational research. Its usefulness, however, is not limited to students of educational research, although the reader in other fields will find all too few of the concrete examples selected from his specialty.

It is not a dry compendium of rules and injunctions—though the product gives evidence of a systematic long-time collection of these—but essays rather to present table-making as a psychological enterprise, an attempt to motivate the reader of a statistical report "to see my facts as I see them." Even a technically correct table may be lacking in reading comprehension. A title, for example, may give emphasis to the important idea or even omit it, and the mechanical arrangement of a table may facilitate or retard the comprehension and the extraction of the intended relationships and comparisons. The authors recognize that "there are still intelligent people who make a practice of skipping tables in their reading . . . "

The casual reader will find the going a little difficult because so much has been condensed into so few pages and because so many backward and forward page references are necessitated by using a limited number of tables in one section of the book for a goodly proportion of the total illustrations.

The authors have done a valuable and much-needed service in attempting to standardize table construction. With this standardization the reviewer in the main heartily agrees. He cannot, however, give his personal sanction to the use of Roman numerals for table numbers even "when there are twenty-five or fewer tables," nor to the publication at the *top* of an intercorrelation table of the means, standard deviations, and, presumably, the populations, reliability coefficients, and the like. He is sympathetic with the expressed wish that publishing houses could be induced to put in a supply of special one-character matrices for certain much-used complex statistical symbols. [Perhaps that is a function, for the future, of our Association?] Such symbols, in the reviewer's opinion, should be extended to include one-digit symbols for publishing coded original data which would reduce the publishing costs to such a point that graduate colleges might require publication of original data in all dissertations. This practice would facilitate checking, make the author more-than-usually-responsible for his work, allow reworking by alternative methods, and permit a newly discovered formula to be applied quickly to established data with known constants for comparisons of efficiency or of methods. The authors of the present volume have gone but little into the possibilities of such "general purpose" tables but rather have devoted most of their space to derived or "special purpose" tables.

The reviewer ventures to predict that, stimulated by the appearance of this volume, the topic of standardization of tables will be expanded in the near future. The fact is that statistics is a language and as such has a psychology as well as a mathematics. It is an artificial languge and would be more than usually amenable to useful standardization by appointed representatives of the practicing profession.

This little text will be a friend in need for the student writing his first research report; and it will be worth a reading by all who make tables. Until such time as the Association gives attention to the matter of standardization of table-making practices, as has the engineering fraternity in the matter of graphic representation, it will take its rightful place in the research student's three-foot shelf of practical reference works.

Herbert A. Toops

The Ohio State University

Middletown in Transition, A Study in Cultural Conflicts, by Robert S. Lynd and Helen Merrell Lynd. New York: Harcourt, Brace and Company. 1937. xviii, 604 pp. $5.00.

It would be gratuitous to enter into an extended discussion of the contents of a work following the same general plan and subject matter as its well-known predecessor of 10 years ago. Suffice it is to say that this is a re-survey of the same middle-western city covered by the same authors' previous volume. As such, the present volume covers the period of the depression and gives an illuminating account of its impact upon various aspects of the community's life. Its favorable reception is not only a recognition of its excellence as a monograph in contemporary anthropology but is also a sort of index to the present stage of development of sociology. This stage (as represented by this volume and its predecessor) is far beyond that of the sociological novel, and the literature of muckraking, moralizing, and reform. On the other hand, sociologists have not yet become generally concerned with the problem of generalizing illuminating incidents, anecdotes, and case studies into a system of principles or laws accompanied by the more careful reservations and restrictions as to the conditions under which stated sequences and correlations may be expected to occur and the degree of probability of their occurrence under these conditions. Signs of the transition toward this latter stage are, however, apparent in the volume under review as contrasted, for example, with its predecessor. Thus, there is, if my impressions are correct, in the present volume, much more attention to the problems of sampling, the quantitative corroboration of impressions, and a constant recognition of possible distortions resulting from the methods employed. At the same time it retains the literary flavor, the rounded picture, and the "life" and "reality," as we fondly designate those characteristics which correspond to our sociological stereotypes.

The above classification of the volume in the series of stages through which the social sciences are likely to pass is in no sense a reflection upon the quality of this volume or upon the superlative competence of the authors. Numerous imitations have appeared on the market since the success of the first *Middletown*, but the Lynds easily retain their lead in the present volume. *Middletown in Transition* will doubtless remain as a classic of its type. Nor is the value of this type of sociological literature to be minimized. It has a vast influence in gradually habituating students, not to mention the public, to the idea of taking a relatively objective view of the community and the social order in general. This is a very important function. It provides, furthermore, a wealth of hypotheses for testing by the more rigorous scientific techniques. What could be more valuable, for example, in the construction of an attitude test designed to determine the actual frequency and intensity of the beliefs constituting "The Middletown Spirit" (Chapter XII), than the list of more than a hundred of such "values" sensed by the authors from "the press, and the civic clubs, and in the folk talk in the streets and about the family dinner table"? The perspicacity of the artist in sensing and suggesting such hypotheses, sequences, and interrelations as are suggested on every page of this book will always be an important part of the scientific quest. In addition to these scientific values of this volume, there is, of course, its great practical and historical significance as a document, a portrayal of contemporary life, and an exposition of the latter's incongruities, their costs and their compensations in terms highly meaningful to the nontechnical reader. Such contents, assembled and presented with the competence here to be found, demonstrate again the outstanding talent of the authors in this field. Finally, the attention of statisticians may be called to the three statistical appendices on (1) population, (2) banking data in boom and depression, and (3) 51 miscellaneous tables on a great variety of economic and sociological topics. There is an excellent index.

GEORGE A. LUNDBERG

Bennington College

Can Delinquency be Measured? by Sophia Moses Robison. New York: Columbia University Press. Published for the Welfare Council of New York City. With a Foreword by Professor R. M. McIver. 1936. xxvi, 277 pp. $3.00.

One of the fundamental problems of the methodology of the social sciences is the definition of terms used. Sometimes these terms are designations of things described or counted; again they are units of measurement. In this painstakingly critical study, Mrs. Robison attacks a problem that has too long gone uninvestigated, namely, the unit of measurement in juvenile delinquency.

Practically all the studies of delinquency that have involved a measurement of its amount have relied on one definition of a delinquent or of a delinquency, namely, that which implies official contact with a court handling juveniles brought in for being delinquent. The definition of delinquency in practically all the states is so broad that it includes not only the crimes with which adults might be charged but also many acts that are not in the criminal code. In this respect it differs sharply from the definitions of crimes, which are exceedingly explicit and very exactly construed by the courts. This vagueness of definition is, then, an underlying weakness in the use of the term "delinquency." The core of the present inquiry is not this vagueness, however, but it is the inadequacy of the official recognition by a court as a definition of a delinquent or a delinquency.

The inadequacy of court recognition has long been known and discussed in crime statistics. Although many European countries have based their indexes of crime upon the number of persons charged, or of cases begun in the courts, there is general agreement now that these are faulty measures of crime. Today we look to the reports of crimes known to the police for a more sensitive index than that of cases in the courts. We are well aware of the inadequacy of even these sources, for many crimes are not reported at all and some of those reported never occurred. We assume—for want of more certain information—that about the same proportion of all crimes will be known to the police from time to time and from place to place. The latter phase of the assumption is perhaps the weaker of the two. Both depend on a further premise of honesty and industry by the police in the reporting procedure. It has been pointed out that court statistics, because of their foundation on public records, have a superior validity as sources. In some respects this point may be true, but there are so many slips 'twixt the commission of the crime and its appearance on a court docket that this superiority is more apparent than real.

Like many other good pieces of critical work, this is an attack on a position of great respectability in the field. The ecological studies of Shaw and his co-workers in Chicago and other American cities have attracted much interest and approval. Briefly their position is this. Certain areas of American cities are in a state of deterioration. The forces of city growth produce this effect, through the crowding and proximity of the central business section, through the movement of the population outward in proportion to its income, and through the rapid physical decay of housing. Specifically, a deteriorated area is near the business and manufacturing centers, has speculatively high land values with no immediate commercial use for the land, the absentee owners of which allow the houses to run down. Such areas are inhabited by the poorest elements of the community, usually immigrants, some from Europe and others from the South of the United States. Successive immigrant groups pass through these areas on their way up the economic ladder. But the area remains, and its pernicious effects are felt in each of these waves of immigrants.

Shaw found that there was a definite falling off in delinquency rates as one progressed from the center to the periphery of Chicago. The evidence seems not so strong for other cities, although some fundamental similarities were found there also. For Chicago this tendency is found to hold for truancy and adult crime as well.

Mrs. Robison points out the following characteristics of these (and several other) studies:

1. Only apprehended delinquents are counted.
2. There is insufficient subclassification of delinquents by age, sex, and types of delinquency.
3. No question is raised as to the "fundamental appropriateness of a geographical rate, though there is some consideration of the size of the geographical area."

She raises the following questions:

1. What is the real relationship between the amount of apprehended and unapprehended delinquency? Can this relationship be measured?
2. Are there constant factors which influence the official registration of delinquent behavior?

To answer these questions she conducted an analysis of these series of cases of the calendar year 1930:

Series A: 10,374 delinquents, of whom 7,090 were known to the Children's Court, 2,116 to official agencies other than Children's Court, 828 to unofficial agencies, and 340 to mental hygiene clinics. For all of these it was the first contact with the agency.

Series B: 3,132 carried over from a previous year, classified as in Series A by type of agency.

Series C: 3,668 truants, children known either to the Bureau of Attendance, or to other agencies, or to both.

The conclusions which the author reaches may be classified as follows:

The recognition of the behavior of children as delinquent will be determined to a considerable degree by group attitudes and customs. A more accurate description of the particular type of behavior is therefore necessary.

"Court figures in New York City neither measure the extent of juvenile delinquent behavior, nor do they represent necessarily the more serious types of anti-social conduct." Moreover, different areas show variations in reporting delinquent behavior, depending frequently on police activity, activity of unofficial agencies, and the abundance or lack of facilities for the care of children of a particular race or religious affiliation.

Differences appear with regard to sex and age. Fewer girls and fewer children under 10 appear in the court than in the unofficial agencies. Negro children appear almost exclusively in the Children's Court and other official agencies. New York City has roughly equal proportions of Catholics, Protestants, and Jews. In the court figures there are roughly seven Catholic children to one Protestant, and three Catholics to one Jew. In the total count the Catholic-Protestant ratio remains the same (seven to one) but the Catholic-Jewish ratio falls to two and one-half to one. Religious categories however, are not homogeneous, Irish (Catholic) children furnish less than their proportion of delinquency and Italian (also Catholic) children furnish more when compared with their proportions in the child population. Again, children of immigrant parents show different proportions of delinquency: both Italians and Russian Jews have this handicap, but the Italians make a far worse adjustment.

As for the precipitating question of this study, the feasibility of area studies of delinquents, the author summarized her findings as follows:

The fraction which becomes a rate has as its numerator the number of delinquents and as its denominator the number of children "at risk," i.e., of the appropriate ages in the given area. If the definition of delinquency is that of official recognition, the numerator has different meanings as one passes from one area to another, from one race to another, from one cultural group to another. The denominator is directly related to the size of the area. If the area is too small, the rate is unreliable when subjected to the usual tests. If the area is large, then the rate ceases to have any significance because of the heterogeneity of the population base. Furthermore, recent studies of the methodology of geographical rates throw grave doubt on the applicability of the mathematical tests to the rate based on an area population.

Finally, the author finds no evidence in New York City of the concentric pattern of delinquency found by Shaw in Chicago. This difference has topographic and historical reasons. It throws doubt on the universality of at least certain of the Chicago author's generalizations.

The reviewer must add a note of approval for the skill with which the statistical analysis in this study has been carried out. It seems at every point to leave no hole in the armor of reasoning. The author lays no claim to having made any great contribution to the inquiry as to causes of delinquency. She has, however, put up a sign on this road of investigation: "Road under repair. Travel at your own risk!"

C. E. GEHLKE

Western Reserve University

Child Workers in America, by Katherine D. Lumpkin and Dorothy W. Douglas. New York: Robert M. McBride & Company. 1937. Appendix, 292 pp. $3.50.

Intensive investigation of several hundred family histories of child labor experience underlie the authors' approach to this study. The book, therefore, goes beyond the confines of the census statistics of child workers and studies them in their family and class surroundings. This is why the authors can and do so convincingly demonstrate that coupled with the economic exploitation of minors goes much of their deprivation of educational and physical development.

In the South, the relatively larger proportion of child workers come from Negro homes and from the homes of tenant families both Negro and White.

Everywhere, in the North and the South, they come from the homes of the poorest working class families. It is a characteristic of child labor throughout that the very exploitation of the child workers makes possible the exploitation of the parents and elder brothers and sisters. In times of mass unemployment, the adults in the family lose their jobs first. During the 3 years 1929–31, in the group studied by the authors, 60 per cent of the fathers suffered the experience of unemployment; 40 per cent of their sons and daughters 20 years of age and over; but only 25 per cent of the members of the families ages 16 to 20.

No special group of employers is guilty of the economic exploitation of children. Child labor is employed because it is cheaper, and any and all business will employ child labor if and whenever it can be successfully substituted for adult labor. "The matter boils down to this," the authors state, "when businesses consider the labor of children to be not only cheap, but sufficiently productive to be profitable, children are hired." "Primarily," they add in another connection, "children are forced onto the labor market by the condition of poverty and the threat of economic insecurity which is the common every-day experience of the American working class."

What to do about it? The history of regulation of child labor is a record of dismal failure. The opposition to reform has been too strong. Arrayed against the abolition or even effective regulation of child labor are all the business interests that profit by the labor of minor children. Supporting these business interests are a front of righteous dignitaries of church and culture.

President Nicholas Murray Butler opposed the Child Labor Amendment because, under it, Congress would "take over the control of the nation's children . . . " Said a Cardinal of the Catholic Church: "The Amendment now drawn is a long step in the direction of the nationalization of children which is the great desire of extreme socialists and bolshevists. . . "

New forces must, therefore, assume the struggle for the control and regulation of child labor, the authors contend. These must come from organized labor, having the support of the large middle class of small business men, farmers, and professional workers, and the struggle must be waged both on the economic and the political fronts. The authors do not delude themselves into thinking that child labor under the present system of business economics can be abolished. So long as business dictates the political and economic policies of the country, and so long as business profits from child labor, its complete abolition is unattainable, they maintain. Still, a great deal can be done by way of alleviating its most flagrant abuses. The authors propose three steps as requisite to such regulation and control:

1. Federal legislation applying to all occupations, industrial as well as agricultural, domestic as well as street trades. This requirement is self-evident in the face of the inadequacies and ineffectual enforcement of state legislation.

2. Universal compulsory education of adequate standards, Federally supported to insure enforcement.

3. A system of social insurance to protect wage-earning families against the loss of income occasioned by unemployment, sickness, accident, maternity, widowhood, and old age. The system of social insurance must be adequate "to create a bottom below which living standards are not allowed to fall, so that the wages of the children who usually try to find work are unnecessary. . . "

JOSEPH M. GILLMAN

Washington, D. C.

Twins: A Study of Heredity and Environment, by H. H. Newman, F. N. Freeman, and K. J. Holzinger. Chicago: The University of Chicago Press. 1937. xvi, 369 pp. $4.00.

For 10 years the authors have collected information on twins, and here they present the results of their investigation. This had for its main purpose "to secure evidence on the extent to which the characteristics of human beings, especially their ability and behaviour, are determined by their genetic constitution and the extent to which these characteristics are influenced by the conditions of the environment." Two series of cases constitute the material: a group of 100 pairs of twins reared together and a group of 19 pairs of identical twins who were brought up in different households.

The first series of cases was selected to include 50 pairs of identical and 50 pairs of fraternal twins, classified as such chiefly on the basis of similarity in palm and finger prints; physical appearance; color of hair, eyes, and skin; and in shape of teeth. The authors believe that this method of classification is more reliable than that based on the histologic study of chorions. It should be noted, however, that owing to the method employed there is no evidence that all the twins called identical are actually monozygotic. The differences between the two members of identical-twins pairs and of fraternal-twins pairs have been compared with respect to physical measurements: stature, weight, head length and breadth, and cephalic index, and to the results of psychological tests: Binet, Otis, Stanford Achievement, Downey, and Woodworth-Mathews. From the comparisons it appears that between twins classified as identical there is a high degree of resemblance in physique, much more than that found between twins of the fraternal group. These are, for certain dimensions, no more alike than ordinary sibs of the same sex. The degree of resemblance between twins classified as identical is not striking relative to their responses to tests of general ability, achievement, and personality or temperament; in a good number of cases identical twins appear to be as different as fraternal twins. It is inferred from these findings that mental traits, especially personality, are more influenced by environmental conditions than are physical traits. This conclusion may be entirely correct, but it cannot be accepted at face value without corroboration because, it must be remembered, physical appearance was one of the principal criteria used in the classification of the twins.

The case histories of 19 pairs of identical twins who were reared in different households and who lived apart for a period of time varying from 13 to 34 years are presented in detail together with the results of physical measurements and psychological tests. It is found that in stature and head measurements, separated twins differ no more than identical twins reared together. In weight, intelligence, and school achievement, separated identical twins differ as much as fraternal twins. Moreover, there seems to be a high degree of correlation between differences in these characteristics and differences in environment.

The essential facts uncovered by the analysis of this mass of material appear to be that such characters as stature and head measurements are less susceptible, whereas weight and certain mental traits are more susceptible to environmental conditions. These facts are not sufficient to permit any broad generalizations, and the authors conclude that probably the main contribution of their investigation has been to indicate that the study of the relative influence of heredity and environment is far more complex than generally realized. It might be added that the complexities of the problem have been increased by the method of classification employed, as has been noted, and by the fact that psychological tests have at best a limited value as a measure of intelligence and other mental traits.

In a review limited to noting the essential findings, adequate justice cannot be done to this book, which represents one of the most complete and extensive works on the subject. The authors have critically reviewed the literature and discuss fully other aspects of this problem such, for example, as the probable significance of differences in handwriting. Of particular interest for the statistician are the methods employed in the analysis of differences between twins. Correlation and variance techniques have been utilized, and the comparisons of the results are instructive.

ANTONIO CIOCCO

The Johns Hopkins University

Principles of Medical Statistics, by A. Bradford Hill. London: The Lancet Ltd. 1937. vii, 171 pp. 6/-.

Followers of medical journals have noted the growth in the proportion of articles which are quantitative in character and have seen the need of medical workers for training in methods for handling such data. The editor of *The Lancet*, recognizing this need, last year invited Dr. A Bradford Hill, Reader in Epidemiology and Vital Statistics in the University of London, to prepare a series of simple articles on the statistical methods most useful in the medical field. These articles proved to be so valuable that *The Lancet* has now reissued them in book form.

The task which Dr. Hill undertook is not an easy one, for he attempts not only to set forth certain procedures with sufficient clarity so that the nonmathematical reader will be equipped to apply them but also to show why they are needed and the philosophy underlying their development. It is gratifying to report that he succeeds admirably in this attempt. His success is largely due to the fact that he employs a wealth of medical illustrations and gives his explanations in terms of these examples rather than in mathematical language. The real strength of the book comes, however, from the interpretative discussion of results and emphasis on the logical principles basic in the reasoning.

The procedures selected for presentation have wisely been limited to a small number, yet they are sufficient for the great majority of problems encountered by the medical man. They include the tabulation of raw data into a frequency distribution; the calculation of mean, standard deviation, and correlation coefficient; sampling tests concerned with these constants, with percentages, and with frequency distributions; and analysis of survival after treatment in terms of life table procedure.

The discussion of these topics is enriched throughout by comments on aims, pitfalls, and interpretation in statistical treatment, but these considerations are not limited to the explanation of specific methods. They are further amplified in the first two chapters on aim of the statistical method, and selection, and in the last four chapters on fallacies and difficulties, and general summary. In these chapters, as in the intervening chapters on method, the medical man is treated, not to abstractions, but to a discussion of the concrete problems which he meets in quantitative studies.

There are three pages of definitions of terms and an adequate index at the end of the book.

One exception to the characteristic clarity of presentation occurs in the discussion of significance of difference of two percentages, where two alternative lines of reasoning are suggested (p. 74). The second alternative is confused in statement so that the question as to exactly what hypothesis is being tested is quite obscure. This alternative is mentioned but not clearly restated in the treatment of the difference between means.

For any person proposing to do work in quantitative biology and untrained in statistical methods, this book will furnish an excellent introduction to the reasoning involved in drawing sound conclusions, and it is a book that every medical man should absorb who is either a contributor to or a critical reader of the present-day medical journals.

LOWELL J. REED

School of Hygiene and Public Health
The Johns Hopkins University

Physicians and Medical Care by Esther Lucile Brown. New York: Russell Sage Foundation. 1937. 202 pp. 75 cents.

It is a pleasure to greet the appearance of a layman's book on medical education and medical economics which can be recommended widely. Much is being published which pretends to be objective and authentic but which is, in reality, merely the outpouring from propaganda groups. The non-expert in the field must be cautious and wary. Miss Brown is to be congratulated; she has run the gamut of the origins and evolution of medicine in the United States soundly and has managed to combine this with a discussion of current problems which is forthright and courageous as well as accurate and restrained. The continuity of the past with the present and with the future is subtly effected through the simple device of presenting 202 pages of text without breakdown into chapters. The sweep of the discussion is broad, and the pace is rapid. Diligence and skill have combined to produce a product which is wheat without chaff.

The origins of American medicine are very humble. It is apparent from this small volume that the problem of the nineteenth century was to devise means whereby physicians might be more adequately trained and the medical sciences developed to the point where they would provide a sound foundation on which the practice of medicine could be built. The degree of success with which this dual problem has been solved is little short of phenomenal.

Medicine is only an aspect of the general civilization of a country. This point is well illustrated for the nineteenth century in the United States by a passage, quoted by Miss Brown from President Charles W. Eliot. The young President of Harvard University was proposing moves in the interest of raising the standards of the Harvard Medical School. The head of the School was so greatly disturbed by the recommended changes that he declared the President was about to wreck it and that it would cease to exist in a year or two if such revolutionary reconstruction were allowed. "He actually proposed," said this professor, "to have written examinations for the degree of Doctor of Medicine. I had to tell him that he knew nothing about the quality of Harvard medical students. More than half of them can barely write. Of course they can't pass written examinations."

Contrast the situation which this quotation reveals with what is now required in medical training. One may feel justly proud of the heights through which medicine, assisted by the onward sweep of social evolution, has lifted itself by its bootstraps. It may not yet be said that all or even many of the fundamental problems in medical education and training have been "solved." "Solution" is dynamic and not static. Certainly, whoever may incline to be overly enthusiastic will have his spirit dampened when he considers the problems of specialization and its control with which medicine still finds itself confronted. Yet the past casts a shadow before, and a backward look gives encouragement. The march of events, their trends, their courses are well staked out in this little volume.

Changes in the number of medical students and graduates and changes in the number of physicians engaged in medical practice are here clearly shown to be related not only to trends in educational standards but also to the strivings for professional status. The distribution of physicians is related not only to these figures but also to the basic economic requirement that even a physician must earn a living. Where there is poverty or limited purchasing power, there the medical equipment of society (hospitals and other facilities, as well as physicians) is often deficient; where there is wealth and purchasing power for medical service, as well as for other services or for material things, there is often an excessive equipment for medical care. Where the need for service is greatest, its deficiencies are also commonly greatest. These anomalies need correction, but the adjustments must be made carefully and skillfully, with due regard for the relations of excess or deficiency to *true need* as distinguished from current *effective demand.*

New forms of medical service fall into two broad classes: those concerned with new methods of furnishing service; those concerned with new arrangements to pay for it. Despite the long history behind many of these so-called new schemes, and despite their wide variety and the multiplicity of their accomplishments, they deal with only a fraction of the social need. But they are the experiments, and their successes and their failures will help to mark the paths along which larger undertakings will go. Miss Brown presents them for the reader in brief compass and with measured weight.

In her last section, under the title "Adequate Medical Care for All the People," Miss Brown has wisely discussed the history and *status quo* of health insurance and of state medicine. She does not, however, fall into the error—now widespread and common—of presenting these as mutually exclusive alternatives. To the contrary, her discussion makes as clear as may be, what is seen by all who are not blind to realities, namely, that health insurance and state medicine are mutually complementary and not mutually exclusive alternatives.

The following passages from the concluding pages deserve direct quotation:

> If the problem of the nineteenth century was that of the initiation of better medical schools and of concentration upon the basic sciences, the problem of the twentieth century is that of devising ways and means whereby adequate care can be provided for the entire population and physicians compensated fairly for the service rendered. This is primarily an economic problem, in which both physicians and society are involved, for both have much at stake. It matters little how excellent professional preparation may be, if the physician finds himself unable to render adequate care because of the persistence of outworn methods of delivering service or because of the inability of patients to pay for needed attention. From the point of view of society, it makes slight difference how many physicians there may be, if large parts of the population have not been taught to consult them and if plans have not been put into operation whereby the cost for those persons in the low-income groups can be so financed that they may have sufficient medical care.
>
> Various experiments, such as those in the field of voluntary health insurance that have already been recorded, look toward a partial solution of a pressing need. Studies of compulsory health insurance and extension of state-supported medical services point to other ways of making care more widely available. It is evident that thinking has shifted in the direction of the needs of the masses, and the demands of society become increasingly more exigent.

> Regardless of the attitude of those physicians and medical societies who would preserve the status quo, there are a great many individual physicians, members of the health services, and lay persons concerned with questions of health who believe that change is imminent, and that only through change can there be progress.

On the last point, there is ample verification in the documented study, *American Medicine: Expert Testimony Out of Court*, published by the American Foundation since the appearance of Miss Brown's book.

Finally, one word more. Though the casual reader may not recognize it, this little book required delicacy in preparation and courage in publication. In addition, however, it required courage from the sponsor. The subjects are controversial, and missteps are costly. All who will read it will feel an obligation and a debt to The Russell Sage Foundation under whose auspices it was prepared and published.

I. S. FALK

Washington, D. C.

Cost of Government in the United States 1934–1936, by Lewis H. Kimmel. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies Number 235. May 1937. xiii, 137 pp. $3.50.

This is the twelfth volume of the National Industrial Conference Board's series presenting data of the cost of government in the United States. For state and local governments the only comprehensive figures are those compiled by the United States Bureau of the Census once in every 10 years. The task of the National Industrial Conference Board, therefore, has been first to collect such data as are available and, by means of carefully compiled estimates, some of them based upon data obtained by questionnaires and other correspondence, to supply annual totals. Secondly, it has been to bring together these figures of state and local units and the data for the Federal Government. The task obviously involves much labor, and the National Industrial Conference Board is to be commended for making this convenient summary available currently to the public. The material is presented in 52 tables and 9 charts with appropriate textual comments, the present volume running to 137 pages in all—an extremely compact presentation for such a body of facts.

In view of the problem of Federal finances, particular attention is given to this subject in the present volume, the discussion going somewhat beyond the textual summary of the data to which most of the comment in the book is confined. In addition to the discussion of Federal finance in conjunction with expenditures and taxation of the other governmental units, a separate brief chapter is devoted to the Federal deficit. Expenditures, receipts, and the resulting deficit are presented through the fiscal year 1936, and these figures are followed by a brief discussion of the budgets for the two following fiscal years. The very large deficit for 1936, amounting to 4-¼ billion dollars, was attributable, to the extent of 1-⅞ billion dollars, to payments under the Adjusted Compensation Payment Act. Aside from this item, the highest deficit appeared in 1934 (3.6 billion dollars); the 1935 deficit amounted to 2.9 billions. In commenting upon the budgets for 1937 and 1938, the author points out that the estimates of future expenditures depend upon assumptions which may or may not be fulfilled. In connection with the resulting growth in the Federal debt the text brings forward briefly the main problems involved: the persistence of the upward trend; the extent to which Federal obligations have found their way into the banking system; the necessity of recurrent refunding operations of considerable size; and the question of the absorption of the debt into the social security funds if the reserve system established for these funds is carried out as now provided in the law.

The figures compiled by the Board for local indebtedness make possible comparison with Federal indebtedness. In 1922, when Federal indebtedness stood at 23 billion dollars, the state and local figures totaled 10 billion dollars. Up to 1930 the expansion of the latter indebtedness more than offset the reduction effected by the Federal Government, so that the total stood at 34 billion dollars, with a slightly higher figure for states and localities than for the United States (18 billion dollars against 16 billion dollars). From 1934 through 1936, while Federal indebtedness was increasing to over 33-½ billion dollars, state and local indebtedness likewise rose, reaching about 20 billion dollars; the total for the two was thus about 53-½ billion dollars.

Comparison of the amounts of indebtedness in this country is made with the debts of Great Britain, Germany, and France, with due warning that the figures are not to be considered strictly comparable. In sharp contrast with the expansion in the United States debt from 1930–1936, which amounted to 56 per cent, the British debt rose only 6 per cent but was still considerably heavier per capita, amounting to approximately $1,000 a person, on the basis of $5 pounds, as against $416 in the United States. Indebtedness in Germany and France has shown smaller increases than in the United States. The figures indicate that the known debt was much smaller in Germany than in the United States, whereas the French debt was "closer to that of the United States than are the debts of the United Kingdom and Germany."

Second in the public interest only to the foregoing general considerations is the question of the extent to which the Federal Government has taken upon itself the relief burden during the years of depression and recovery. Figures taken from the Federal Emergency Relief Administration show totals rising from 793 million dollars in 1933 to 1,827 million dollars in 1935. Of these sums the Federal Government supplied 61 per cent in 1933, 72 per cent in 1934, and 74 per cent in 1935. The extent to which the Federal Government has become the agency of relief is indicated even more clearly by the fact that in three sections of the country—the South Atlantic states, the East South Central states, and the West South Central states—it furnished over 90 per cent of the total in 1935. Only in the New England states was the percentage less than 60; only this section and the Middle Atlantic states show percentages below the average for the country (74 per cent).

The more general comparisons between Federal and state and local operations are also of interest and importance. The figures show that the decade of the twenties when Federal expenditures were increased little, was, nevertheless, a period of large expansion because of the rise in the amount spent by the state and local governments. The annual total increased from 9 billion dollars in 1923 to 12 billion dollars in 1930. By 1935 (the last year for which comprehensive expenditure figures are given) the aggregate had risen to 15 billion dollars as the result of increased Federal expenditure. The latter, which had formed 35 per cent of the total in 1923 and dropped to 27 per cent in 1930, formed 46 per cent of the total in 1935. The general record of tax collections is not greatly unlike that of expenditures. Comparing the years 1930 and 1935 we find Federal tax collections exceeding the 1930 figure by about 80 million dollars and state tax collections by 95 million dollars, whereas local taxes were 722 million dollars lower. The total for 1935, 9.7 billion dollars, was approximately 550 million dollars less than in 1930. Nontax receipts were estimated at 2 billion dollars for all governments in 1935.

Some judgment of the weight of the tax burden is possible by a comparison of the Conference Board's figures with national income. Tax collections in 1923 amounted to 11 per cent of such income and those in 1930 to 14.2 per cent. By 1935 the percentage had increased to 17.7, the last figured against the national income of 55 billion dollars. Whether national income has kept step with the increase in taxation since that year remains to be seen. Another method of judging weight of taxes in the United States is through comparison with those in the United Kingdom, France, and Germany. There is obviously difficulty in making direct comparisons on a per capita or income basis. The National Industrial Conference Board has presented the material in the form of a chart showing tax collections in these three countries since 1930. This shows graphically the fact that British taxes have been maintained throughout the depression, in 1935 standing 6 per cent above 1930. The United States, France, and Germany show sharp declines in the intervening years, but it is noteworthy that the 1935 tax collections in the United States were within 5 per cent of the 1930 figure and in Germany within 7 per cent of that figure.

The contribution of the National Industrial Conference Board volume consists in supplying data upon which some appraisal of the cost of our government activities is possible, and in bringing together information upon all government bodies so that the water-tight compartments into which thought on governmental finance tends to fall are broken down. Most statistical critics will probably find the explanation of methods given in the appendix unsatisfactory for their purposes; it was, perhaps, not designed to meet such needs. The chief difficulty lies in the fact that the information given does not make possible a mathematical statement regarding the importance of the estimated portion of the figures. Presumably this portion is greater in the most recent years reported than in the earlier years, and, also presumably, it is not sufficiently important to impair the validity of the most recent figures, but there is little in the present description of methods which would enable the reader to form a mathematical judgment on these points.

JOSEPH B. HUBBARD

Harvard Business School

Facing the Tax Problem, A survey of Taxation in the United States and a Program for the Future. New York: Prepared under the Auspices of the Committee on Taxation of the Twentieth Century Fund, Inc. 1937. xxiii, 606 pp. $3.00.

This volume was prepared under the auspices of a Committee on Taxation of the Twentieth Century Fund. The research work was carried on under the direction of Professor Carl Shoup (Columbia), research director, and two associate directors, Professor Roy Blough (Cincinnati) and Professor Mabel Newcomer (Vassar), who were assisted by a staff of 17 members.

The book aims to describe the taxation system now existing in the United States including state and local taxes as well as Federal taxes. It goes further and not only presents a valuable critique of these various taxes individually and as a whole (summing this up in 102 conclusions) but makes specific recommendations as to what should be done to improve them. There are two sets of recommendations: first, the directors of the survey present 50; and, then, the Committee on Taxation of the Twentieth Century Fund make some 35 recommendations covering a much more limited area than that covered by the directors. A considerable number of the recommendations of the Committee coincide with those made by the directors, but the Committee adds some of its own and in its report presents some interesting material not found in the survey.

There are some places in the study in which statements are made without enough of the material upon which they were based being presented. In most of these cases, however, reference is made to another volume, "Studies in Current Tax Problems," which is to be a companion study of the one under consideration and which will undoubtedly supply this material.

The weakest portion of this study, in the judgment of the reviewer, is the chapter dealing with the distribution of the tax burden. The writer of this chapter recognizes the difficulties of this problem and qualifies the results. The reviewer in no way wishes to criticize the work of this writer but merely expresses his opinion that so many assumptions must of necessity be made in working on this problem that any conclusions reached cannot be relied upon to any great degree.

The study is most excellently organized and unusually well annotated, as might be implied from the fact that there are 72 pages of notes. There is also a good bibliography. The volume is one of the most comprehensive works on taxation that has appeared and should be owned by every student of public finance and studied carefully by all who are interested in trying to make use of taxes as a means of social control or for any reason to change in any respect our present system of taxation.

HENRY F. WALRADT

Ohio State University

How Shall Business Be Taxed? New York: Symposium conducted by the Tax Policy League, December 28–29, 1936, in Chicago, Illinois. 1937. vii, 175 pp. $2.50.

This volume contains 12 papers presented in a conference conducted under the auspices of the Tax Policy League on the problem of business taxation. The treatment is limited in its scope, as there is no discussion either of the special taxes placed upon particular kinds of business or of the various forms of property, sales, and franchise taxes which affect business enterprise. Considerable space is devoted to theory underlying business taxation, and special attention is given to the discussion of the very timely subjects of the financing of social security and the taxation of undistributed profits. One of the best papers, in the opinion of the reviewer, discusses the question as to whether flat or graduated rates should be used in connection with business net income taxes, and the conclusion reached is in favor of a flat rate. A very good, although not complete, bibliography of business taxation adds to the value of this very readable volume.

HENRY F. WALRADT

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